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SCIENCE AND THEOLOGY.

BY RICHARD A. PROCTOR.

WHILE thoroughly recognising the liberal and kindly spirit in which Dr. Healy (letter 1488, p. 372) deals with the relations between science and theology, I cannot but demur to the manner in which he compares the two. He sets on the one hand the study of Science and on the other the study of Theology, as if these were different departments of research. Men of science, according to his view, may become well acquainted with matters belonging to their own department, but are ill-fitted to express opinions on matters relating to theology; and *vice versâ*.

Are men rendered more fit to understand religious relations by giving much time to theological study? The answer to this question will depend on what we understand by theology. Dr. Healy seems to understand by it "our old beliefs and hopes." He appears to identify "revealed religion" with "theology." But, if he is right in this, he surely is wrong in regarding theology as a department of research; for not only in Christian teaching, but in every form of religion claiming to be revealed, it has constantly been held that to the unlearned, nay to those who are as babes and sucklings, the truth has been revealed which the wise and learned have been unable to receive, or by study to understand. Those to whom was entrusted religious teaching in old times were for the most part not men who had given much time, many of them had not given any time at all, to theological study. If but a single one were so selected of old, Dr. Healy's objection to men of science "who seek to become his religious teachers" falls to the ground. If a man who had been all his life a fisherman could be worthily selected to become a fisher of men, I can see no reason why a man who has given a large part of his time to chemical investigations (let us say) might not be a most potent or even a divinely-ordained teacher of religious doctrines. I do not know that any man of science has ever claimed to become a religious teacher, as Dr. Healy appears to imply. I know of no man of science who has ever asked the theologian or any man "to give up his beliefs or hopes." But if any had done so, no one would have a better *à priori* right to object to a man of science who should speak about religious matters, than the Scribes and Pharisees of old had to object against Andrew and Peter, that "though quite ready to admit" these twain as excellent fishermen, "they strongly objected to them as religious teachers." There is nothing in the study of God's universe, any more than there is in net-making with Peter or tent-making with Paul, to render a man objectionable as a religious teacher. It might be urged with at least equal force that *theological* training was unsuitable for a religious teacher, seeing that not one of the founders of wide-spread religions has ever selected a theologian for apostolic work. Paul may be mentioned as an exception. Yet, though he lived according to the straightest sect a Pharisee, and though he had (or it was at least objected to him that he had) "much learning," and has given theologians much to think about, there is nothing to show that, according to the modern acceptance of the term, he was a theologian.

It may perhaps be urged that in our time the teacher of religion *must* be a theologian. I know not what would have been said on this point by the apostles of the early Christian Church. But those who know anything of the system of education and training adopted for religious teachers and theologians in the principal Christian churches of our time, can hardly find that there is much in the system to justify Dr. Healy's tone. I myself passed through all the theological examinations at the University which are required from men who are to become clergymen, except that one which is notoriously the easiest of them all, besides receiving a preliminary training at King's College (the chief Church-of-England College in London) which put me at the "head of my year" in Divinity. Yet, so far as religious teaching is concerned, I can see nothing in anything I then learned that even approaches in its influence the effect of those studies that bring before the mind the infinite vastness of God's domain, its eternal duration, and the perfection of the laws which prevail throughout its whole extent alike in Space and Time. What is really held by many theologians to be anti-theological in science, is in reality that which makes the teachings of science most solemn and impressive: Science teaches that God's domain is not a little circle of the earth's surface arched over by a star-spangled dome which is the floor of heaven, and hiding beneath it the sulphurous caverns of Hades, as appearances once taught men to imagine, but infinite space strewn with infinite multitudes of suns and sun-systems; Science has read from the earth (God's work, and therefore His word, if we can but read it aright), that for millions, nay for tens and hundreds of millions of years in the past, the laws of that domain, as now revealed to us, have been maintained —so perfect are they—without occasion for change or interference; and science has learned to look as far forwards as backwards. Science, in fine, presents the Universe of God as aptly symbolising what we have been taught to consider the attributes of God Himself. It is this that so many theologians regard as anti-theological, because narrow theologies have pictured God after their own image, with which these infinite grandeurs are not consistent.

I am quite aware, however, that Dr. Healy himself disclaims any such feeling. He accepts the teachings of science, but appears to imagine that science wishes to emphasize the discrepancies which he finds between these doctrines and his religious beliefs. I do not know of any man of science, or real student of science, who has done more in this direction than simply to defend his scientific teachings where impugned because of such imagined dis-

crepancies. A host of men, theologians and otherwise, are ever ready to denounce scientific teachings on such grounds. The trouble is that there is no avoiding their denunciations. Those of the milder sort deny that they are troubled because of such objections as the more virulent and foolish are ever ready to raise. But they swell the cry of the opponents of science all the same. Dr. Healy may take exception only to our review of the sillier anti-scientific works as implying that the writers of such works are theologians instead of the dolts and ignoramuses he perceives them to be; or he may only be troubled because a writer on science (who may have given this particular point much more careful study than ninety-nine out of a hundred clergymen) speaks of the Books of the Pentateuch as assuredly not written by Moses (as if by the way *this* were in any sort or degree a theological question; and as if it had not been shown by men who have thoroughly studied this archæological subject, that Moses could not possibly have written those books as they stand). But his objections come in company with those of multitudes of persons whom we could not possibly satisfy, even though we could satisfy Dr. Healy. Why, I have been publicly objurgated for teaching that the stars are suns lying in the midst of infinity (or what to us is practically infinity) of space, in all directions around us—for no better reason than that in one of the books of the bible we are told that the heavens are God's throne and the earth His footstool (a statement which, so understood, would require us further to believe that over Edom God had cast out His shoe). By quite a large number I have been asked whether it is not irreligious to accept the teachings of astronomy, when, if accepted, they leave no place for heaven, or for hell either,—an interpretation of bible phrases which would leave it rather difficult to explain what was intended by the statement that to produce the flood "the windows of heaven were opened."

It has only been in this sense, or rather through such nonsense as this, that anything in the slightest degree anti-theological can ever be said to have appeared in the columns of Knowledge. Any man can accuse a writer of being anti-theological who chooses to start a theological school of his own, and to say that the teachings of science about God's universe are inconsistent with his own narrow ideas respecting the domain and the power of the Almighty. Any one can educe from his own nature conceptions of what God is and how God acts; and because his own nature is small and spiteful, or cruel and despotic, or conceited and overbearing, may denounce the ever-widening range over which Science extends its survey—seeing God in all and through all, too great to be within our ken, too powerful for us to be able even to conceive His might, too Wise for us to follow the workings of His mind, His Infinite Comprehension of all things that are and have been and will be throughout Eternity. But Science has nothing to fear from such attacks. Her business is to study God's universe without fear or anxiety, lest suddenly she should discover something mean or unworthy therein. She cannot fear lest "some hysteric sense of wrong or insult should convulse the throne where Wisdom reigns supreme." When She is told to take the shoes from off her feet because the ground on which she treads is holy ground, She answers that God's whole domain is holy to them that rightly think of it: not this thought or that feeling, but all our thoughts and all our feelings about the universe should be full of reverence, because all things—the great and the small, the long-lasting and the short-lasting—are full of mystery, instinct with infinite wonder. In the words of the science poet, Goethe (quoted to this effect by one of those most roundly denounced by men regarding themselves absurdly as defenders of religion):—

Gleams across the mind His light
Feels the lifted soul His might:
Who then dare deny His right
The All-Enfolder?

Who dare to name His name,
Or belief in Him proclaim—
Clothed in mystery as He is,
The All-Upholder?

PLEASANT HOURS WITH THE MICROSCOPE.

By Henry J. Slack, F.G.S., F.R.M.S.

I AM often asked to advise intending purchasers of microscopes what they should look for, and the question is just now very seasonable, as many parents are anxious to make a really useful and handsome Christmas present to their sons and daughters. No intelligent family should be without a microscope, but the size and sort should be decided by the use likely to be made of it. Medical students find a small, strong, portable instrument of simple structure the most useful for following histological demonstrations, and the powers recommended as essential are 1 in., $\frac{1}{4}$ or $\frac{1}{6}$ in., with two eye-pieces. Instruments of this sort cost from £5 to £6 or £7, and they suffice for ordinary purposes; but they are not adapted either for the best display of beautiful objects or the exhibition of difficult ones. Many English makers follow French and German patterns, and give their microscopes short tubes. This is handy for a student's rough use, but for steady, quiet work the English tube length of about nine inches is to be preferred. It is brought up to ten inches when the objective is added. The length of the tube determines the amount of magnification to be obtained with a given eye-piece and objective. The longer the tube the greater the power, and many instruments are made with draw-tubes for the purpose of obtaining this advantage to a greater extent. It is chiefly applicable to the lower powers, as with a quarter and upwards the performance is injured unless the objective is used with the tube-length best suited to it. In buying foreign high-powers this should be thought of.

A microscope that can only be used in a vertical position is not desirable, as looking through it keeps the head in an uncomfortable and wearisome attitude. For prolonged observation a horizontal position is the best, but for common purposes the tube may slant at about 45 deg.

The range of movement given to the tube for focussing varies with different patterns. The best instruments allow a 4-inch objective to be used for large objects, and so much pleasure and information can be obtained with this low magnification that it is well to require a stand that will permit its employment.

The amount of magnification obtained with various eye-pieces and objectives is reckoned by comparison with their apparent linear dimensions as seen by a sound and normal eye without any assistance at ten inches' distance. The terms four-inch, one-inch, quarter-inch, &c., mean that the compound lenses of the objective magnify as much as simple ones of these focal lengths.

The cheapest form of microscopes has a simple up and down movement of the slide-holder. A better and more expensive sort enables the slide-holder to be readily moved in any direction, and with best instruments there are two rack and pinion motions at right angles to each other. This is very handy, but not essential even for delicate

work. The stage on which the slides or other object-holders rest is often made to revolve. This is useful when polarised light is employed, and also to exhibit the effects of illuminating objects by light falling at different angles. Thus the beautiful scales of Morphomenalaus exhibit a fine blue tint when the light strikes in one direction, and when the stage is partly revolved the colour is a brownish drab. Many minerals—hypersthene, for example—show brilliant colours in one position and none in another. There is also a great convenience in a revolving stage, to bring objects into a convenient position for studying or drawing. Perhaps a rotifer is stretched out at an angle that does not show it to advantage, and would appear awkward in a sketch. The rotating stage enables it to be seen upright.

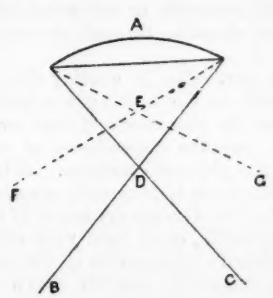
All microscopes are supplied with a mirror below the stage to throw light up, and the best have two mirrors—one flat and the other concave. These should be mounted so that they can be moved considerably on one side, and slanted so that a very oblique light can be sent through any translucent object, which then appears luminous upon a dark ground.

An achromatic condenser fitting under the stage is of great use for the best display of delicate structures. It is provided with stops which keep out more or less of the central rays, and little holes to let only small pencils through. The cheaper instruments are not adapted to carry this apparatus; but, if the price can be afforded, it is better to have one that will, though a beginner is better without it until he has learned to make the best use of the substage-mirror. The condenser should give a good dark ground field when required.

A binocular instrument costs more than a single one. If the prism which diverts part of the light-beams to form a second image is good, an object viewed, say, with half-inch power, should be defined sharply and clearly whichever tube is looked through. If intended for use with high powers, Stephenson's pattern is the best. Before deciding on having a binocular instrument, the person who is to use it should ascertain whether his eyes are an optical *pair*. A slight difference does not matter; but, when one focus is considerably further off than the other, a binocular is of little use. When both eyes match, the effect is excellent, and fatigue from continuous observation is less felt.

Beginners are puzzled to know what is meant by the angle of aperture of object-glasses, and what is the effect of it.

Let A be the front lens of an objective, B C two rays of light making an angle, B D C. That is the angle of



aperture, and it means that the objective is open to, and can bring to a focus, rays of that degree of obliquity. But it may be constructed to bring such rays at F G to a focus, and their angle, as seen at E, is larger than that at D. There are proportions between focal length and angles of aperture which give the best definition. This is often exceeded for the purpose of showing dotted and lined objects, such as diatoms; but naturalists and physiologists condemn the plan on several grounds. Such objectives are less accurate, and have little *penetration*—that is, they cannot show both the surface of object and layers a little below it. They also can only work very close to an object in proportion to their magnifying power, and this is extremely inconvenient, especially when living creatures are under investigation. When it is considered that a good microscope is a permanent treasure in a house, it is worth while to begin with one as good as can be afforded. The most costly instruments are luxuries. All they can do can be done with simpler and much cheaper means, but it is not wise, if it can be helped, to stop short of what are reckoned good second-class stands. The objectives should be of the best quality, and only advanced students will do any good with powers higher than $\frac{1}{4}$ or $\frac{1}{6}$. In all cases they and the microscope tube objectives should be made with the universal screw.

OUR TWO BRAINS.

By Richard A. Proctor.

(*Continued from p.* 436.)

THE remarkable phenomena presented in cases of dual or intermittent consciousness appear to throw light on the subject we are dealing with, because they can apparently be interpreted in no other way (when *all* are considered) than by the theory that the brain is double. Let us consider a few cases of dual consciousness:—

Brown-Sequard mentions the case of a boy at Nottinghill who had two mental lives. Neither life presented anything specially remarkable in itself. The boy was a well-mannered lad in his abnormal as well as in his normal condition—or one might almost say (as will appear more clearly after other cases have been considered) that the *two* boys were quiet and well behaved. But the two mental lives were ert rely distinct. In his normal condition the boy remembered nothing which had happened in his abnormal condition; and *vice versâ*, in his abnormal condition he remembered nothing which had happened in his normal condition. He changed from either condition to the other in the same manner. "The head was seen to fall suddenly, and his eyes closed, but he remained erect if standing at the time, or if sitting he remained in that position (if talking, he stopped for a while, and if moving, he stopped moving); and after a minute or two his head rose, he started up, opened his eyes, and was wide awake again." While the head was drooped he appeared as if either sleeping or falling asleep. He remained in the abnormal state for a period which varied between one hour and three hours; it appears that every day, or nearly every day, he fell once into his abnormal condition.

This case need not detain us long, but there are some points in it which deserve more attention than they seem to have received. It is clear that if the normal and abnormal mental lives of this boy had been entirely distinct, then in the abnormal condition he would have been ignorant and—in those points in which manners depend on training—ill-mannered. He would have known only, in this condition, what he had learned in this condition; and as only about a tenth part of his life was passed in the abnormal condition, and presumably that portion of his life not usually selected as a suitable time for teaching him, the abnormal boy would of necessity have been much more

backward in all things which the young are taught than the normal boy. As nothing of this kind was noted, it would appear probable that the boy's earlier years were common to both lives, and that his unconsciousness of his ordinary life during the abnormal condition extended only to those parts of his ordinary life which had passed since these seizures began. Unfortunately, Brown-Sequard's account does not mention when this had happened.

It does not appear that the dual brain theory is required so far as this case is concerned. The phenomena seem rather to suggest a peculiarity in the circulation of the brain corresponding in some degree to the condition probably prevailing during somnambulism or hypnotism though with characteristic differences. It may at least be said that no more valid reason exists for regarding this boy's case as illustrating the distinctive duality of the brain than for so regarding some of the more remarkable cases of somnambulism; for though these differ in certain respects from the boy's case, they resemble it in the circumstances on which Brown-Sequard's argument is founded. Speaking generally of hypnotism—that is, of somnambulism artificially produced—Dr. Carpenter says, "In hypnotism, as in ordinary somnambulism, no remembrance whatever is preserved, in the waking state, of anything that may have occurred during its continuance; although the previous train of thought may be taken up and continued uninterruptedly on the next occasion when hypnotism is induced." In these respects the phenomena of hypnotism precisely resemble those of dual consciousness as observed in the boy's case. In what follows, we observe features of divergence. Thus "when the mind is not excited to activity by the stimulus of external impressions, the hypnotised subject appears to be profoundly asleep; a state of complete torpor, in fact, being usually the first result of the process just described, and any subsequent manifestation of activity being procurable only by the prompting of the operator. The hypnotised subject, too, rarely opens his eyes; his bodily movements are usually slow; his mental operations require a considerable time for their performance; and there is altogether an appearance of heaviness about him which contrasts strongly with the comparatively wide-awake air of him who has not passed beyond the ordinary biological state."

It would not be easy to find an exact parallel to the case of the two-lived boy in any recorded instance of somnambulism. In fact, it is to be remembered that recorded instances of mental phenomena are all selected for the very reason that they are exceptional, so that it would be unreasonable to expect them closely to resemble each other. One case, however, may be cited, which in certain points resembles the case of Dr. Brown-Sequard's patient. It occurred within Dr. Carpenter's own experience. A young lady of highly nervous temperament suffered from a long and severe illness, characterised by all the most marked forms of hysterical disorder. In the course of this illness came a time when she had a succession of somnambulistic seizures. "The state of somnambulism usually supervened in this case in the waking state, instead of arising, as it more commonly does, out of the conditions of ordinary sleep. In this condition her ideas were at first entirely fixed upon one subject—the death of her only brother, which had occurred some years previously. To this brother she had been very strongly attached; she had nursed him in his last illness; and it was perhaps the return of the anniversary of his death, about the time when the somnambulism first occurred, that gave to her thoughts that particular direction. She talked constantly of him, retraced all the circumstances of his illness, and was unconscious of anything that was said to her which had not reference to this subject. . . . Although her eyes were open, she recognised no one in this state—not even her own sister, who, it should be mentioned, had not been at home at the time of her brother's last illness." (It will presently appear, however, that she was able to recognise those who were about her during these attacks, since she retained ill-feeling against one of them; moreover, the sentences which immediately follow suggest that the sense of sight was not dormant.) "It happened on one occasion, that when she passed into this condition, her sister, who was present, was wearing a locket containing some of their deceased brother's hair. As soon as she perceived this locket she made a violent snatch at it, and would not be satisfied until she had got it in her possession, when she began to talk to it in the most endearing and even extravagant terms. Her feelings were so strongly excited on this subject, that it was deemed prudent to check them; and as she was inaccessible to all entreaties for the relinquishment of the locket, force was employed to obtain it from her. She was so determined, however, not to give it up, and was so angry at the gentle violence used, that it was found necessary to abandon the attempt, and having become calmer after a time, she passed off into ordinary sleep. Before going to sleep, however, she placed the locket under her pillow, remarking, 'Now I have hid it safely, and they shall not take it from me.' On awaking in the morning she had not the slightest consciousness of what had passed; but the impression of the excited feelings still remained, for she remarked to her sister, 'I cannot tell what it is that makes me feel so, but every time that S. comes near me I have a kind of shuddering sensation;' the individual named being a servant, whose constant attention to her had given rise to a feeling of strong attachment on the side of the invalid, but who had been the chief actor in the scene of the previous evening. This feeling wore off in the course of a day or two. A few days afterwards the somnambulism again returned; and the patient being upon her bed at the time, immediately began to search for the locket under her pillow." As it had been removed in the interval, "she was unable to find it, at which she expressed great disappointment, and continued searching for it, with the remark, 'It *must* be there—I put it there myself a few minutes ago, and no one can have taken it away.' In this state the presence of S. renewed her previous feelings of anger; and it was only by sending S. out of the room that she could be calmed and induced to sleep. The patient was the subject of many subsequent attacks, in every one of which the anger against S. revived, until the current of thoughts changed, no longer running exclusively upon what related to her brother, but becoming capable of directions by *suggestions* of various kinds presented to her mind, either in conversation, or, more directly, through the several organs of sense."

I have been particular in quoting the above account, because it appears to me to illustrate well, not only the relation between the phenomena of dual consciousness and somnambulism, but the dependence of either class of phenomena on the physical condition. If it should appear that dual consciousness is invariably associated with some disorder either of the nervous system or of the circulation, it would be impossible, or at least very difficult, to maintain Brown-Sequard's explanation of the boy's case. For one can hardly imagine it possible that a disorder of the sort should be localised so far as the brain is concerned, while in other respects affecting the body generally. It so chances that a remarkable case, dealt with a few years since by French men of science, forms a sort of connecting link between the boy's case and the case just cited. It closely resembles the former in certain characteristic

features, while it resembles the latter in the evidence which it affords of the influence of the physical condition on the phenomena of double consciousness.

(To be continued.)

THE WORKSHOP AT HOME.

By a Working Man.

(*Continued from p. 405.*)

BY this time the amateur will have begun to acquire a certain amount of mastery over his tools, and to handle them much more familiarly, and to more immediate purpose, than he did as an absolute beginner. We may now treat ourselves to two tools not mentioned in the list on p. 154, I mean a beading-plane and a brace and bitts. The beading-plane has an iron of an approximately semi-circular curve, corresponding with that of a slip of box-wood, inlaid into the bottom of the plane; so that if carried along the edge of a board, it cuts a moulding represented in perspective by A, and in section by B, in Fig. 27. What is known as a $\frac{1}{2}$-inch plane of this sort

Fig. 27.

will be found a handy size by the amateur. It is surprising how much can be done in the way of effective ornamentation by such a simple tool. The brace and bitts are shown in Fig. 28. The head, C, of the brace is pressed

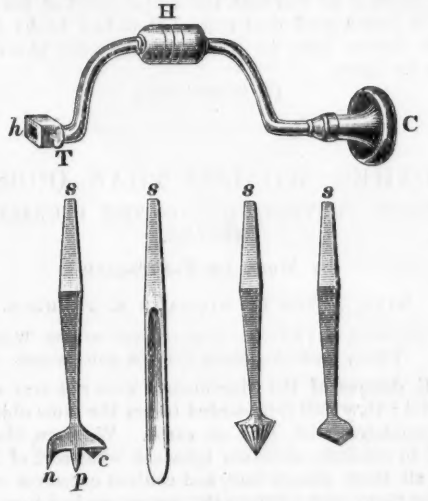


Fig. 28.

against the workman's chest; the shanks of the bitts, S, fit into the square, so that, being retained in position by the thumbscrew, T, their points are forced against the work to be bored by the pressure, and the brace is turned round by the ball or handle, H, which moves quite freely round the iron; as does the iron again inside of the head, C. The first bitt to the left is the ordinary centre-bitt for boring clean cylindrical holes in wood. The point, *p*, is inserted into the centre of the hole to be bored, the nicker, *n*, cuts the hole truly circular as the bitt rotates, while the cutter, *c*, at right angles to the edge of the nicker, cuts spiral shavings within the space marked out by the nicker. The second object is a spoon-bitt, also used for boring cylindrical holes. The third figure shows a rose-bitt which is employed to "countersink" the surface of wood to admit the head of a screw. The fourth object represents a countersink for metal. As the amateur can buy one of these bitts at a time, adding as it were bitt by bitt to his stock, I need not pursue my description any longer here. There is a costly form of wooden brace sold, but the one shown in Fig. 28 is very cheap and just as effective.

To-day we will try and make a set of bookshelves. The dimensions will, of course, depend upon the size of the space which the maker has to fill. As an example I will imagine that they are to fit into a recess in a room, and be "hanging" shelves—*i.e.*, are not to rest on the ground—are to be 4 ft. high, 3 ft. wide, and 6 in. deep. To make them we shall want 28 ft. of 1-in. wood 6 in. wide when planed up, so that we must buy 7-in., or if procurable $6\frac{1}{2}$-in. stuff, 9 or 11-in. planking cutting terribly to waste for our purpose. Fig. 29 represents our set of shelves completed and erected. We first plane and square up all our board

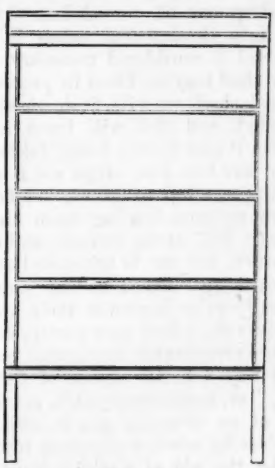


Fig. 29.

carefully, and then mark off two 4-ft. lengths for the sides of the shelves, as we do subsequently three pieces 2 ft. $10\frac{1}{4}$ in. long for the middle shelves on which the books rest, and two pieces 3 ft. long for the top and bottom. Having marked off these lengths with the square, and sawn them off with the tenon-saw, we proceed to "bead" them on both sides of what will ultimately be their front edges, as shown in Fig. 30 both in plan and section. This gives a wonderful finish to the whole thing when put together. 3 ft. of our remaining board we must divide longitudinally into two pieces 3 in. wide each. These are to make a slightly ornamental top to our shelves, to be presently again referred to. Lastly, we must cut out two brackets identically alike (B, Fig. 30), 6 in., of course, wide from *f* to *b*, and 1 ft. deep from *b* to *e*. The best way to do this is to fasten the two pieces of wood side by side, if possible in the bench-vice, draw the form of the bracket carefully on one of them, and saw them both out together with the frame-saw (Fig. 3, p. 154). Still keeping them fastened together, the cut edges may be finished in succession by a rasp, a piece of broken glass, and some fine sand-paper. To make a nice neat job, the top and bottom should be dove-tailed into the sides in the way explained on p. 233. This will give us 3 ft. 10 in. clear in the inside height. Starting

from the bottom of our frame which will be our bottom shelf, we now measure 11 in. up inside of the sides, and placing the square there, draw a line at that height on each side, and another one parallel to it an inch higher up. The wood must be carefully taken out of this to the exact

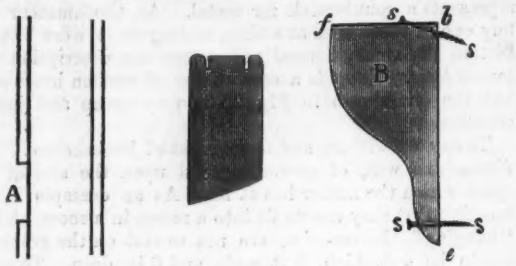


Fig. 30.

depth of the beading ($\frac{1}{8}$ in.) as shown in the lower part of the left-hand figure A in Fig. 30 above; and then, as the inside width of the frame is 3 ft. less 1 in. on each side, or 2 ft. 10 in.; and as the groves on each side is $\frac{1}{8}$ in. deep one of our shelves 2 ft. $10\frac{1}{4}$ in. will accurately fit into the interval, when it may be glued, nailed, or screwed if considered necessary. Eleven inches higher another shelf may be fitted in precisely in the same way. Our third shelf we will fit in at the same distance above the second, and this will leave a somewhat less interval between it and the top board, taking rather smaller books. Out of our two 3-in. strips we finally will make a kind of open box as a top to the whole affair. This we do by planing them up true, beading them on each edge, and mitreing them (p. 356) at the corners; as in Fig. 31, where C shows a corner, *b b* the beading, and *m* the mitre-joint before it is closed up. Fixed on the upper board of the shelves this really quite improves their appearance. But white deal shelves don't look very pretty, so we will proceed to impart a more ornamental appearance to them. To this end, we must buy a bottle of one of Stephens's capital "wood stains;" or, more cheaply still, get a pennyworth of burnt umber at an oilman's, mix it with stale beer, and colour our shelves by rubbing this stain into them, the way of the grain, by the aid of a stiffish brush. An old nail-brush, or even a tooth-brush, answers this purpose very well. When the stain is thoroughly dry, we must size our work—*i.e.*, coat it thoroughly with hot size. And, lastly, when the size is dry in turn, we must varnish everything with oak varnish and a soft brush, taking care not to drive the varnish too bare. *Varnishing should always be*

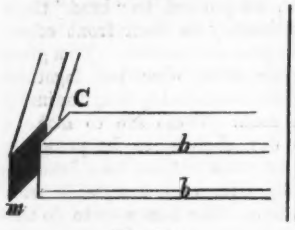


Fig. 31.

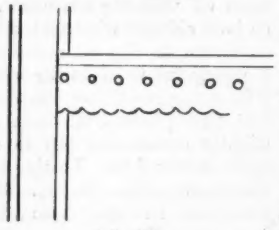


Fig. 32.

done in a hot room, like a kitchen. Cold chills it and makes it assume a dull surface. A very tolerable imitation of oak with the umber, or other wood, according to the (Stephens's) stain used, may be made in the way just described. But we have not finished our ornamentation even yet. We shall require further four yards of the imitation leather made like American cloth, and about sixteen dozen brass-headed nails. As our "leather" is cut into strips 3 in. wide, we only want as much as will make five such strips; in fact, as it is a yard wide, you would only buy *half-a-yard* at the shop, out of which you will get six strips. The bottom edge of this you must "scallop," as shown in Fig. 32, and the top edge must coincide with the groove of the beading as shown in the figure, the brass-headed nails being driven in an inch apart into the flat part of the front edges of the shelves between the grooves. Of course, as the *bottom* edge of each shelf is hidden by the American leather curtain, no absolute necessity exists for beading that at all. With our shelves complete, it only remains to fasten them against the wall. If they are, as I began by supposing, to fit into a recess, screws or nails may go through the sides into the sides of the recess; the brackets being similarly attached. If, though, the shelves are to hang clear, and their sides to remain visible, the brackets must first be fastened to the wall by means of strong screws driven through at the points *s s* (B, Fig. 30). Mind that the holes for these screws are bored in the proper direction—the top one slantingly, the bottom one horizontally, and do not forget to countersink depressions in the wood for the screwheads to enter. The brackets once fixed, the bottom of the shelves will rest on them all right enough. To support the top of the shelves, I have found what are called "angle-irons," to be bought at an ironmonger's for a few pence, very handy. They are simply flat bars of iron bent at right angles, with screw-holes through each arm of them; the upright side being screwed to the wall, the upper flat side to the under-side of the top board. When books are on the shelves these are not seen at all. And now our shelves are completed and put up, I fancy that the amateur will be as pleased with the economy with which he has produced an efficient piece of furniture as he will with the useful result of his labour. He will have a good deal more left to buy books with to fill his shelves than he would had he gone to a cabinet-maker for them.

(*To be continued.*)

OTHER WORLDS THAN OURS.

A WEEK'S CONVERSATION ON THE PLURALITY OF WORLDS.

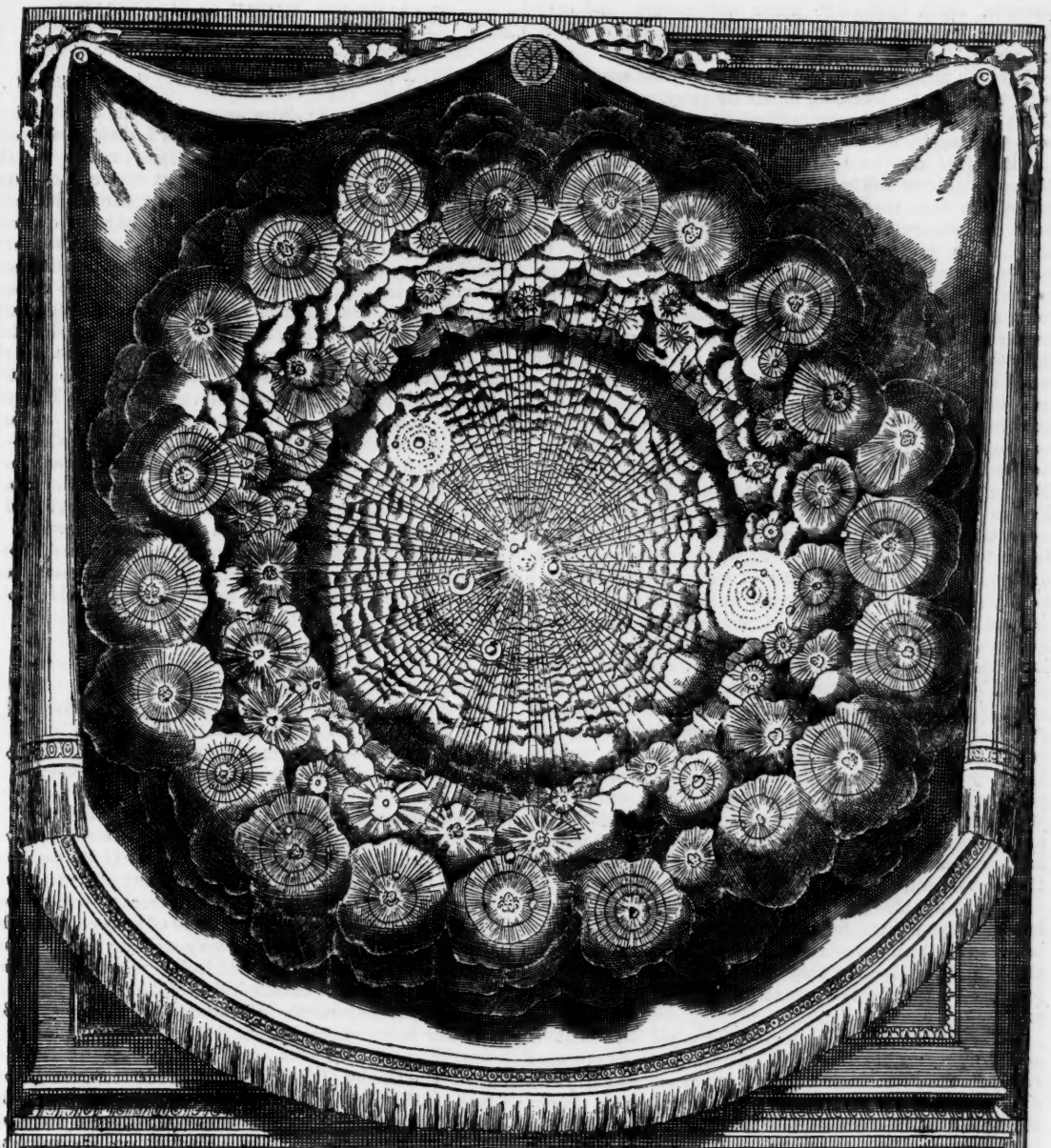
By Mons. de Fontenelle.

WITH NOTES BY RICHARD A. PROCTOR.

THE FOURTH EVENING.—Particulars of the Worlds of Venus, Mercury, Mars, Jupiter, and Saturn.

THE dreams of the Marchioness were not very successful; they still represented to her the same objects we are acquainted with here on earth. We were, therefore, forced to conclude ourselves ignorant what sort of inhabitants all these planets had, and content ourselves only to guess at them, and continue the voyage we had begun thro' these several worlds. We were come to Venus, and I told her, that Venus certainly turn'd on itself, tho' nobody could tell in what time; and consequently were ignorant how long her day lasted; but her year was compos'd of eight months, because it is in that time she turns round the sun. And seeing Venus is forty times less than the earth, the earth appears to them in Venus to be a planet, forty times bigger than Venus appears to us on the earth: and as the moon is forty times lesser than the earth, so she seems to be just of the same magnitude, to the inhabitants of Venus, as Venus seems here to us.

"I see, then," says the Marchioness, "that the earth is



1. Mercury. 2. Venus. 3. The Earth. 4. Mars. 5. Jupiter. 6. Saturn

not to Venus what Venus is to the earth: I mean, that the earth is too big to be the Mother of Love, or the Shepherd's Star to Venus; but the moon, which appears to Venus of the same bigness as Venus appears to us, is assigned to be the Mother of Love, and Shepherd's Star to Venus; for such names are only proper for a little brisk, airy panet, bright and shining as the goddess herself. Oh, blessed moon, how happy art thou to preside over the amours of those gallant inhabitants of Venus, where all they say is soft and moving, and perfectly refined!"

"O, without doubt," says I, "the very common people of Venus are all Celadons and Silvanders, and their most trivial discourses are infinitely finer than any in Clelia: their very climate inspires love; Venus is much nearer than the earth to the sun, from whence she receives a more vigorous and active influence."

"I find," says the marchioness," it is easy enough to guess at the inhabitants of Venus; they resemble what I have read of the Moors of Granada, who were a little black people, scorched with the sun, witty, full of fire, very

amorous, much inclined to music and poetry, and ever inventing masques and tournaments in honour of their mistresses."

"Pardon me, madam," said I; "you are little acquainted with the planet. Granada, in all its glory, was a perfect Greenland to it; and your gallant Moors, in comparison with that people, were as stupid as so many Laplanders."

"But what do you think, then, of the inhabitants of Mercury? They are yet nearer to the sun, and are so full of fire that they are absolutely mad. I fancy they have no memory at all, like most of the negroes, that they make no reflections; and what they do is by sudden starts, and perfect hap-hazard. In short, Mercury is the bedlam of the universe: the sun appears to them much greater than it does to us, because they are much nearer to it than we: it sends them so vast and strong a light that the most glorious day here would be no more with them than a declining twilight. I know not if they can distinguish objects; but the heat to which they are accustomed, is so excessive, that they would be starved with cold in the torrid zone. Their year is but three months; but we know not the exact length of their day, because Mercury is so little, and so near the sun: it is (as it were) lost in his rays, and is very hardly discovered by the astronomers; so that they cannot observe how it moves on its centre; but because it is so little, fancy it completes its motion in a little time: so that by consequence the day there is very short, and the sun appears to them like a vast fiery furnace at a little distance, whose motion is prodigiously swift and rapid, which is so much the better for them, as it is evident they must long for night*; and during their night, Venus and the earth (which must appear considerably big) gives light to them. As for the other planets which are beyond the earth, towards the firmament, they appear less to them in Mercury, than they do to us here, and they receive but little light from them, perhaps none at all: the fixed stars likewise seem less to them, and some of 'em totally disappear, which, were I there, I should esteem a very great loss. I should be very uneasy to see this large convex studded with but few stars, and those too of the least magnitude and lustre.

"What signifies the loss of a few fixed stars?" says the lady; "I pity them for the excessive heat they endure; let us give them some relief, and send Mercury a few of the refreshing showers they have sometimes four months together in the hottest countries, during their greatest extremity."

"Your fancy is good, Madam," reply'd I; "but we will relieve 'em another way. In China there are countries which are extremely hot by their situation; yet in July and August are so cold that the rivers are frozen: the reason is, they are full of saltpetre, which, being exhal'd in great abundance by the excessive heat of the sun, makes a perfect winter at midsummer. We will fill the little planet with saltpetre, and let the sun shine as hot as he pleases. And yet, after all, who knows but the inhabitants of Mercury may have no occasion either for rain or saltpetre? If it is a certain truth that Nature never gives life to any creature, but where that creature may live; then, thro' custom and ignorance of a better life, these people may live happily."

(*To be continued.*)

It is stated that the January number of the *Cornhill Magazine* will contain an article upon Charles Dickens, written by his eldest daughter, entitled "Charles Dickens at Home," with special reference to his relations with children.

* Only then their nights would be correspondingly short: but perhaps they work at night and hide in caves by day.—R. P.

RAMBLES WITH A HAMMER.

By W. Jerome Harrison, F.G.S.

GEOLOGY OF CRICCIETH AND PWLLHELI (*continued*).

ABOVE the Arenig slates we come to the *Bala Beds*—coarse black and blue slates and shales, with occasional bands of sandstone—which form nearly all the surface of the Lleyn peninsula, except where they wrap round, or are pierced by, rocks of an igneous character. There are many exposures of the Bala beds in quarries, cuttings, and cliffs; and in such spots it is almost always possible, by patient search, to find such characteristic fossils as corals, trilobites, and brachiopods. The roadside cuttings near Pwllheli, the grounds of Boduan Hall, Crugan near Llanbedrog, and Plas-hen, may be named as good localities for fossil-hunting. The coarseness of the sediment and the abundant evidence of contemporaneous life, indicate that the Bala beds were deposited in a shallow sea. This sea-bottom was not so frequently disturbed by volcanic eruptions as the part which lay further east, where—in Snowdon, for example—we have *alternations* of fossiliferous strata of Bala age with lava flows and consolidated ash-beds. But those igneous rocks, which in Lleyn are found to be connected with the Silurian strata, are intrusive in them, cutting across the beds, and altering the rocks *above*, as well as those below. Such intrusive masses must necessarily be of *later* date than the strata which they traverse.

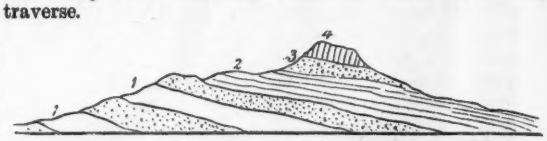


Fig. 1.—Moel-y-gest. 1. Lingula Flags; 2. Tremadoc Slates; 3. Arenig Beds; 4. Greenstone Intrusive in Arenigs.

The thickness of the Bala beds of Lleyn is unknown, but is probably less than 2,000 feet. The strata have no regular dip, but undulate over the surface of the peninsula, so that they cover a very large area, hiding all but a narrow fringe of the Cambrian and Arenig rocks beneath them, and lapping round the harder masses of igneous rocks which rise up as hills. The effect is very striking when we stand on any of these eminences, and look across the low plain of the Bala beds to the distant hills. All the high points owe their present superiority in altitude to the greater *hardness* of their rocks, which has enabled them to resist better the wearing-down forces of sea and river, rain, frost, and ice. The height of the hills is from 900 ft. (Carn Boduan) to 1,887 ft. (Yr Eifl), while the surface of the plain of Bala beds from which they rise does not average more than 400 ft. above sea-level. The Bala beds are the newest, or latest-formed, of the regularly stratified rocks which occur in the peninsula of Lleyn.

The Surface Deposits.—Under the name of *Drift* we include all the relics of the last glacial period—the stones, clay, sand, &c., which formed the moraines of the ancient glaciers. Some quarter of a million years ago, it appears, from causes partly cosmical, but, perhaps, in part geographical, the northern ice-cap of this planet stretched southwards to somewhere near lat. 50° in Western Europe. The mountains of Wales then furnished a gathering ground for important ice-sheets, which radiated in every direction from the hills. But the glaciers of Cumberland were still larger, and, sweeping southwards, they arrested and deflected the northerly flow of the Welsh ice; then, grinding on southwards, they excavated a long narrow valley, which now forms the Menai Straits; or, as Ramsay forcibly puts it,

"the Menai Straits is nothing but a glacial groove on a grand scale." The glaciers tore off the rough crags, smoothed down the prominences into rounded hummocks, and carried along with them all the débris, forming the boulder-clay which is now visible at many points along the coast, and which covers over the stratified rocks and renders their examination difficult. In ordinary geological maps all these surface deposits are supposed to be swept away, and the various colours on the maps show the different beds of stratified rock which are believed to lie *beneath* the drift; but, as a matter of fact, these glacial beds offer a great obstacle to our study of the older underlying strata. It has at last been resolved by the Government Survey to publish a *double* set of geological maps; the one (as in the present maps) showing the regular stratified rocks only; the other giving the surface of the country as it actually exists, the deposits of sand, mud, boulder-clay, &c., being indicated by distinct colours—the stratified rocks only shown where they form the actual surface upon which we walk. A few such "Drift Maps" for parts of the eastern counties of England have already been published.

The manner in which the ice (which, as Faraday and Tyndall have shown, acts, when under pressure, like a plastic substance) accommodated itself to the irregularities of the surface, flowing down one side of a valley and up the other, is strikingly shown by a large block of greenstone built into the playground wall of the school at Criccieth. Deep and broad grooves—effected by stones frozen into the superincumbent ice, and carried along with it—run along one face of the block, and are continued on the next face, passing *round the corner* of the stone with scarcely a break. Dr. H. W. Crosskey has noted similar examples in basalt blocks from the Rowley Hills near Dudley, and he found a block in a Swiss moraine showing exactly the same thing. Many of the stones in the boulder-clay forming the low coast cliffs west of Criccieth and in Porth-ceiriad show grooves and striations, and their surfaces are often smoothed. The included stones are mostly of local origin, but along the west coast, as between Bangor and Clynnog, fragments of granite which can be referred to the Lake-district, are not uncommon.

After the retreat of the glaciers, the land appears to have been depressed at least 2,000 feet. This is shown by the patches of sand and gravel, containing shells, which occur on the hill-sides. At Moel Tryfan, five miles south of Carnarvon, there are slate quarries at a height of 1,150 feet, and from the gravels which here rest upon the eroded surface of the slates Mr. Etheridge has identified fifty-five species of shells of species such as now flourish in the seas round Iceland and Greenland. This subsidence was followed by an elevation, during which local glaciers again filled the valleys, and more boulder-clay was formed

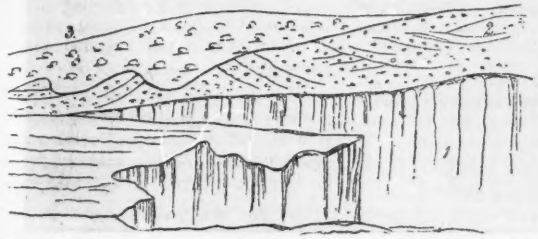


Fig. 2.—Slate Quarry on Moel-Tryfan. 1. Cambrian Slates; 2. Sand and gravel, with sea shells; 3. Boulder clay (after Ramsay).

(Fig. 2). From that time down to the present day other agents of denudation have been at work upon the rocks of Lleyn. The sea has hollowed out the softer strata into bays and inlets; frost has done its wintry work, detaching block after block to form the "screes" which lie at the foot of the "scars;" the rivers have made new valleys, removing a large part of the boulder-clay with which the ancient valleys were filled up; and the rain has aided all these destructive agents in their task. By these means much of the effect of the levelling and smoothing-down done by the great ice-sheet has been obliterated; but although the scenery of Lleyn is to-day full of the most charming variety, yet the evidences of its bygone vicissitudes are, to the geological eye, written clearly upon its surface.

PRE-HISTORIC MAN IN LLEYN.—The stone implements, which elsewhere mark the first appearance of man upon the surface of the earth, occur but scantily in Carnarvonshire. Mr. Darbishire found a roughly-chipped stone celt, or axe-head, at Penmaenmawr, another, not far off, at Dwygyfylchi, and a net-sinker (an oval stone with a groove round it) at Nantlle. Near Aber there is a large stone called Carreg-y-saelhan—stone of the Arrows; it has numerous scorings upon it, from one quarter to half an-inch in depth; but, although it was doubtless used for sharpening tools or weapons of some kind, Mr. Evans thinks it belongs to the Metallic Age. In cairns which he opened near Bangor, Colonel Lane-Fox found numerous rough flakes and splinters of stone, some of which showed signs of rubbing and use on their edges.

Of the Bronze Age—which succeeded the Stone Age—we have a trace in the small bronze dagger-blade which was found, together with a wooden bodkin, at Tomen-y-mur, in an urn, also containing burnt bones.

But the fortifications on the hill-tops, and the cromlechs, are the most striking remains of early man which this region affords to us. The camp on Trer Ceiri—a peak of Yr Eifl—is on a very extensive scale. A double or treble wall of great thickness and extent, and still many feet in height, encloses a number of circular, hut-like stone dwellings. Professor Ramsay calls it, "by far the most striking hold of the kind I have seen in any part of Britain, with its broad parapeted unmortared walls, its flanking defences, and its numerous ruined houses, chiefly circular, enclosed within its bounds." Almost every prominent steep hill-top, as Moel-y-gest, Carn Madryn, Carn Boduan, &c., bears traces of similar camps, possibly erected by the ancient Gaelic inhabitants during the troublous times in the fifth and sixth centuries, which followed the departure of the Romans.

The cromlechs are, without doubt, the burying-places of the chiefs of these early tribes. They are now seen as broad stones, usually five or six feet square, supported by three or four massive corner-stones, four or five feet in height. Probably they were once covered completely with a mound of earth, but this covering has been removed by rain and frost, and by the eager hands of intruders in search of gain, for the mounds, or tumuli, were formerly considered to contain great treasures. There are two fine cromlechs about a mile north of Criccieth. Two others lie three miles north of Pwllheli, but one of these (the northernmost) has only a single stone remaining (if it ever had more, which is very doubtful). There is a fine cromlech near Clynnog, between the village and the sea-shore.

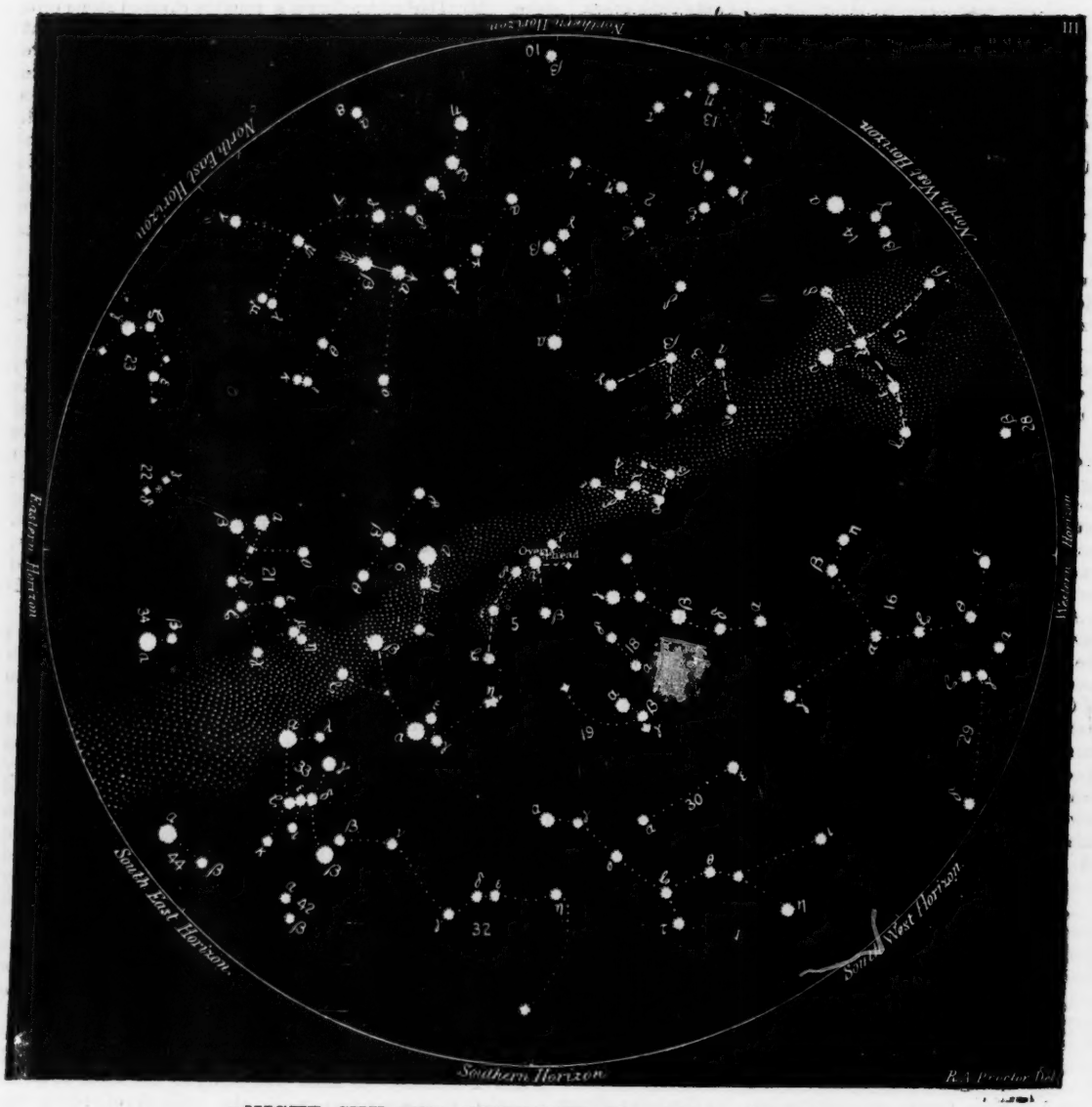
The geologist who visits Lleyn will never regret the time spent there. The eastern part—between Criccieth and Portmadoc—is most interesting to the lover of fossils—the palæontologist—while the student of rocks (the petrologist) will find the extreme west—the tract between Pwllheli and Bardsey Island—a new land, full of problems, which, if he can work them out, will lead him into the eart of the most-debated topics of the geological world. ut for every one this corner of Wales offers lovely

scenery, the purest air, capital fishing, both in the little trout streams and in the sea, with a combination of quiet and comfort such as our "popular" seaside resorts know little about.

FIRST STAR LESSONS.

By Richard A. Proctor.

THE map of the stellar heavens, as presented this week, needs scarcely any explanation. It will be observed that the map has not, properly speaking, top, bottom, or sides; the centre represents the point overhead, the circumference marks the horizon. The stars of the first three magnitudes only are shown, and the constellations are numbered, not named. The numbering begins with the Little Bear, to see which in its proper position the map must, of course, be held with the "Northern Horizon" downwards. The other constellations are taken as nearly as possible in the order of their distance from the pole (α in 1 is the Pole star), from Draco, the Dragon, which being nearest the polar constellation is numbered 2, to Argo, the Ship, which being the farthest from the pole of all those included in this series of maps is numbered 45, the last number in our list. The constellations are also taken around the pole in the order of their right ascension,—or in the direction in which the hands of a watch move,



NIGHT SKY FOR DECEMBER (First Map of Pair),

Showing the heavens as they appear at the following hours:—

December 7 at 10 o'clock.	December 19 at 9½ o'clock.	December 30 at 8½ o'clock.
December 11 at 9¼ o'clock.	December 23 at 9 o'clock.	January 3 at 8¼ o'clock.
December 15 at 9½ o'clock.	December 26 at 8¾ o'clock.	January 7 at 8 o'clock.

around the North Pole, which in the southern skies means from right to left.

The constellations included in the set of maps are numbered throughout as follows:—

1. *Ursa Minor*, the *Little Bear* (*a*, the *Pole Star*).
2. *Draco*, the *Dragon* (*a*, *Thuban*)
3. *Cepheus*, *King Cepheus*.
4. *Cassiopeia*, the *Lady in the Chair*.
5. *Perseus*, the *Champion* (*β*, *Algol*, famous variable).
6. *Auriga*, the *Charioteer* (*a*, *Capella*)
7. *Ursa Major*, the *Greater Bear* (*a*, *β*, the *Pointers*).
8. *Canes Venatici*, the *Hunting Dogs* (*a*, *Cor Caroli*).
9. *Coma Berenices*, *Queen Berenice's Hair*.
10. *Boötes*, the *Herdsman* (*a*, *Arcturus*).
11. *Corona Borealis*, the *Northern Crown*.
12. *Serpens*, the *Serpent*.
13. *Hercules*, the *Kneeler*.
14. *Lyra*, the *Lyre* (*a*, *Vega*).
15. *Cygnus*, the *Swan* (*a*, *Arided*; *β*, *Albires*).
16. *Pegasus*, the *Winged Horse*.
17. *Andromeda*, the *Chained Lady*.
18. *Triangula*, the *Triangles*.
19. *Aries*, the *Ram*.
20. *Taurus*, the *Bull* (*a*, *Aldeburan*; *η*, *Alcyone*, chief *Pleiad*).
21. *Gemini*, the *Twins* (*a*, *Castor*; *β*, *Pollux*).
22. *Cancer*, the *Crab* (the cluster is the *Beehive*).
23. *Leo*, the *Lion* (*a*, *Regulus*).
24. *Virgo*, the *Virgin* (*a*, *Spica*).
25. *Libra*, the *Scales*.
26. *Ophiuchus*, the *Serpent Holder*.
27. *Aquila*, the *Eagle* (*a*, *Altair*).
28. *Delphinus*, the *Dolphin*.
29. *Aquarius*, the *Water Carrier*.
30. *Pisces*, the *Fishes*.
31. *Cetus*, the *Sea Monster* (*o*, *Mira*, remarkable variable).
32. *Eridanus*, the *River*.
33. *Orion*, the *Giant Hunter* (*a*, *Betelgeux*; *β*, *Rigel*).
34. *Canis Minor*, the *Lesser Dog* (*a*, *Procyon*).
35. *Hydra*, the *Sea Serpent* (*a*, *Alphard*).
36. *Crater*, the *Cup* (*a*, *Alkes*).
37. *Corvus*, the *Crow*.
38. *Scorpio*, the *Scorpion* (*a*, *Antares*).
39. *Sagittarius*, the *Archer*.
40. *Capricornus*, the *Sea Goat*.
41. *Piscis Australis*, the *Southern Fish* (*a*, *Fomalhaut*).
42. *Lepus*, the *Hare*.
43. *Columba*, the *Dove*.
44. *Canis Major*, the *Greater Dog* (*a*, *Sirius*).
45. *Argo*, the *Ship*.

PHOTOGRAPHIC RECREATIONS.

By W. Slingo.

THE winter, with all its dull and unpleasant accompaniments, is now upon us; and to one who is fond of the pictures and workings of nature, the prospect is, perhaps, not over gratifying. Recent improvement in the art and practice of photography offer, however, pleasures and enjoyments of no mean order. A writer in this journal pointed out a few months since the many pleasant ways in which, during the summer, a set of photographic apparatus may be employed to while away what might otherwise be tedious and heavy hours, and this, in addition to the satisfaction of having recorded by one's own work, the many beautiful sights and views that may have presented themselves. The object here in view is somewhat different, being rather to indicate some few of the multitudinous ways in which photography may be employed during the duller and heavier months of the year. The winter season is just that time when one may opportunely turn his attention to the educational advantages offered by the young art. It is then that pictorial representations of geological specimens may be obtained without sacrificing those hours which might be more pleasantly occupied in the fields of nature. It is then that copies may be taken of the many views which have been photographed in the summer. It is then that microscopic objects may be pictured on a larger scale. It is then that those marvels of beauty, photographic transparencies, may be secured. It is then, and manifestly then only, that the beautiful snow may be photographed, as it falls to the ground, and provide a picture of surpassing glory. Such are a few, and only a few, of the many attractions offered by photography for usefully and profitably employing leisure hours in winter, to say nothing of the satisfaction which is to be derived from the exhibition of the pictures, or, better still, of lantern enlargements for the edification of the members of one's own circle, and, may be, for diffusing the knowledge one has gained amongst our less learned brethren. There is very little doubt that the art of photography would for each and all of these objects have received many more votaries than it has been favoured with were it not that there exists in the mind of the great majority of people a preconceived objection to it on the score of dirtiness, uncertainty as to results, and the difficulty of transportation. All these objections are, however, overcome by the really gigantic strides which have been made in the development of the art. There is also a somewhat widespread feeling that photography is, to a considerable extent, enveloped in mystery. This is true of all arts and of all sciences until acquaintance with their minutiæ familiarises us with them. Now, to become familiar with the mysteries of photography, and to acquire a sufficient knowledge of the art to make its practice eminently easy and satisfactory, involve no serious difficulties, and it is worthy of mention that the managers of the London Stereoscopic Company, to whom reference has been made in these columns on more than one occasion, have perceived the sphere that is open to any one who fittingly undertakes to make matters clear to the tyro, and to help those who have a mind to help themselves. The company have, therefore, taken the matter up in earnest, creating a department for this special work, and making it one of their chief features. Their plan is a simple one, viz., to make or prepare such apparatus and appurtenances as the amateur (a term used in its widest sense) is likely to require, and on selling an article to impart gratuitous private instruction to such as require it. The fact that four lessons suffice, as a rule, to convert an ignoramus into a proficient amateur, should make it apparent that the supposed mysteries and difficulties are now reduced to an exceedingly low point, and that they exist more in the mind of the uninitiated than in reality.

It is not, however, my purpose to give a *résumé* of the instruction given, but rather, as above indicated, to enter into a few of the many applications to which the art lends itself.

To the naturalist and geologist, perhaps, more than to any other student, photography is a great aid. The preservation of leaves and flowers is an excellent practice in its way, but the objects lose in the process their vitality, and are often squeezed out of recognisable shape. There can be no doubt that a good photographic image of a flower taken in full bloom and full of life must possess many features and many attractions of which the dead reality is not susceptible. This, however, is more a class of work for the summer season. The geologist may go on collecting his specimens in the warm and more genial weather, deferring until the cold season sets in the task of photographing them. The advantages of photography are too self-evident to require further remark. But to the naturalist and the microscopist there are advantages which are less apparent, but which are, nevertheless, equal, if not superior, in importance.

Fig. 1 will help to explain this feature. Let it be supposed that the microscope has revealed to us some new beauty, which we should like to be able to study and admire subsequently, without the necessity of having to resort to a microscope. The desire may be satisfied by first mounting the object on a microscope-slide, and then sup-

porting it in a frame, B, in front of the eye-piece, A, of a microscope. C, is a reflector or lens, from or through which (according as it is one or the other) a beam of light is sent through the object and then through the microscope into a long bellows camera, E, where it falls upon a sensitised

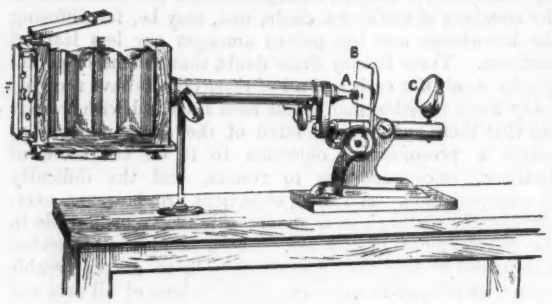


Fig. 1.

plate in the dark slide, F, at the back of the camera. If C be a double convex lens, a paraffin lamp placed to the right will give all the light that is necessary for imparting to the plate at F, an enlarged photographic image of the object, B. The development and fixing of the negative taken at F is a matter of ordinary photographic detail. The myriads of interesting objects that might be thus easily photographed cannot fail to impress one with the fact that there is here alone sufficient recreation for many a long and, perhaps, otherwise tedious winter evening. But when the photographer wishes to display his work to a large circle of friends simultaneously, either at home or in the lecture-hall, what can be better or easier than to adopt the plan illustrated in Fig. 2, where

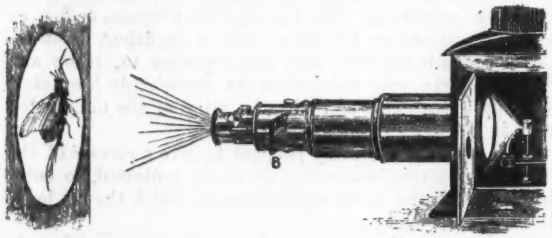


Fig. 2.

a transparent slide, B, is placed in the lantern, and an enlarged projection of the picture thrown on the screen? For large assemblies, lime light or electric light apparatus is necessary; but for drawing-room audiences, one of many good oil-lanterns (and their name is legion) will answer every purpose, while a white window-blind will serve admirably as a screen. Nor need the amateur go far for his transparencies, provided he has a goodly store of negatives. A transparent slide may be easily produced by laying a sensitised plate over the negative (in a dark chamber, of course), and then passing the pair of plates a few times before an ordinary paraffin lamp. The sensitised plate being lifted from the other, the picture may be fixed in the ordinary manner. It is noticeable that these transparencies are being very largely employed on the continent for the purpose of house decoration, windows, more especially those on the staircases, being frequently glazed with them; and I fancy this is a practice which might be adopted nearer home with a pretty and pleasing effect. What I have thus far said is, I imagine, amply sufficient to demonstrate how readily photography may be made to supply us with the means of pleasantly and profitably passing our spare winter evenings. But photography in the present sense of the word, that is to say the taking of negatives during winter, is not altogether a species of Tom Tiddler's ground. There are many views which the winter alone affords —such, for example, as a snowstorm. It is, however, apparent that in taking such a picture the work must be done rapidly, or our flakes of snow will have rather the appearance of icicles. Notwithstanding our comparatively poor light in the colder period of the year, the number of rays reflected by the snow is sufficient to imprint a picture in a very brief space of time. The difficulty is rather to adequately shorten the time during which the plate is exposed. The obstacle is not, however, insurmountable. Fig. 3 is a perspective view of what is at present the best piece of apparatus devised (for ordinary purposes)

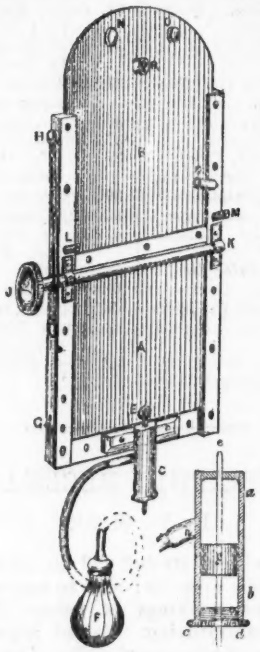


Fig. 3.

Fig. 4.

for mechanically limiting the period of exposure. It is known as an instantaneous shutter. A is a shutter which is attached by its upper edge to the inner side of the brass rod, J K. An elastic band attached at one end to the knot or button H passes a little way round J K, and is then attached by its other extremity to another little button near the end J (not shown). E is a small brass stud on the shutter A, and it is held by means of the above-mentioned spring against the little steel pin seen to protrude from the cylinder C. A sectional view of this cylinder is shown in Fig. 4, where *a b* represents the cylinder, *h* an india-rubber tube connected with a pneumatic ball (F, Fig. 3); *g* is an air-tight piston which slides up and down the cylinder; *e f* are two steel pins, the former fitting closely to a hole in the fixed cap of the cylinder, while *f* fits as closely to the screw-cap *c d*. It is evident that if the ball (F, Fig. 3) be squeezed, air will be forced into that part of the cylinder above *g*, and will consequently force the piston downwards, which will also carry with it the pin *e*. Removing the pressure produces a partial vacuum in the ball,

whence air will rush out of the cylinder, and the piston will be driven up again by virtue of the greater pressure existing beneath it. Reverting to Fig. 3, it will be seen that a pressure of the ball, F, will cause the pin over the brass stud, E, to be forced downwards, the elastic spring connecting H with J K causes the brass rod to revolve, carrying with it the shutter, A. The beam of light will then pass through the opening, previously covered up by A, and impress a picture on the plate waiting to receive it. The revolution of A, however, allows another shutter, B, to fall into its place, and so to close the orifice once more. A flat spring on the side of the frame carries a small peg, which, as B descends, is pressed into a hole in the side of the shutter, so as to prevent it rebounding. L M N O are small brass buttons, around which, when the duration of exposure is required to be very brief, an elastic band is passed, with the result that the rapidity with which B falls is considerably accelerated. D is an indiarubber buffer against which the shutter A strikes, thereby preventing it coming into contact with the other shutter, B. P is a small stud by means of which B may be raised to its ordinary position. This piece of apparatus is wonderfully well-made, and answers its purpose admirably, and if there is anything which the company supplies that I should feel justified in recommending, it is this really instantaneous shutter. Its rapidity in responding to the demands made upon it is astonishing.

I have, perhaps, exceeded the limits usually prescribed in this journal, but the increasing and deserving popularity of the art, and the often-expressed desire to hear of a few of its many applications, afford, I trust, ample apology. One last word I would utter, and that is a warning to such of my readers as may feel disposed to provide themselves with a photographer's *impedimenta*, to deal only with good houses if they really wish to ensure success. It were, perhaps, somewhat invidious to specialise any one establishment, but since the Stereoscopic Company offer so many exceptional facilities to the amateur, I may, perhaps, be permitted once more to mention them.

CHAPTERS ON MODERN DOMESTIC ECONOMY.

VI.—THE FRAMEWORK OF THE DWELLING-HOUSE (*continued*).

GENERAL PRINCIPLES OF CONSTRUCTION.

THE almost universally adopted form of window frame, with its upper and lower sashes balanced by means of heavy lateral counterpoises, has many disadvantages; so many drawbacks are there, indeed, that it is a matter for surprise why they have not long since been superseded by some more rational contrivance. Like many other old-established and defective systems, a sweeping reform can scarcely be applied successfully here; the type of the frame has been taught to, and mastered by, the practical workman until it has become part and parcel of his operative creed. From a commercial point of view, also, the rapid progress of valuable reform is undesirable, and accordingly receives a powerful check. If the accepted type were abolished suddenly, the demand for special pulleys, weights, sash bolts and fasteners, and the sashes and frames themselves would cease, and so much dead stock would crowd the market. Again, the manufacturers of such wares would suffer directly, in being obliged to discard their present working plant and adopt new models. Even partial innovations make but tardy progress, or we would find sashes with universal movement, such as those alluded to in our last communication, more in vogue.

Windows ought to be constructed upon the following principles:—(i), to assist ventilation; (ii), to exclude draft, dust, and rain; (iii), to admit of being thoroughly cleansed with safety; (iv), to be capable of being opened to the full extent of the framework aperture without any inconvenience; and (v), to afford scope to the artistic designer. All of these items ought further to come with the bounds of reasonable expenditure; that is to say, an outlay which shall not exceed the limitation placed by architects upon such structures. A window-frame which incorporates all the advantages enumerated above, has not yet, to our knowledge, been introduced to public notice. We shall reserve our ideas, in special illustration of this subject, to a future chapter.

A great many dwelling-houses are provided with a flight of stone steps to their main entrances and doorways; but the majority of smaller abodes and shops have merely a doorstone, slightly elevated above the street pavement. In all cases, but especially where there is a constant traffic, as at shop doors and greatly frequented public staircases, the edges of the steps invariably give way after a few years of incessant use, and may, in the course of time, become worn to such a degree as to be positively dangerous. Something harder and more durable than the ordinary building stones now employed is, therefore, requisite, and we consider it to be the duty of every modern builder to take advantage of any invention that may secure immunity from prejudicial wear and tear. Messrs. Doulton & Co., of Lambeth, S.E., have introduced a valuable invention in their patent imperishable "Silicon Tread," which may be used with stone or terra-cotta steps, either in or out of doors, and may be readily adapted to any existing stone staircase or doorway slab. We would draw the attention of tradesmen, and owners of commercial buildings more particularly, to this invention; for, through its employment, they will secure a doorstep made of a specially prepared clay, which produces a tread so hard as to be practically everlasting. When fixed in position it is immovable, and affords a firm foothold, on account of its longitudinally corrugated upper surface.

We may now pass on to the consideration of the relative disposition of the rooms and passages of the dwelling-house, without, however, entering into any details of architectural design; for we are here discussing principles rather than examples. All the doorways into halls and passages ought to be provided with adjustable fanlights; for these do not only serve to admit diffused daylight, but are accessories to a well-regulated system of ventilation. The value of fanlights above doors leading into habitable rooms has been much disputed; a little reflection, however, will soon convince one that they only act as ventilators when the windows are open or the fires burning. At all times they give access either by regular currents, or through diffusion, to air from the hall and passages, which is always open to possible contamination. On the whole they are to be discountenanced, as violating one of the most important principles of sanitary house construction, viz., that which seeks to establish the utmost isolation of the separate chambers in the building. Each room ought to have its own special inlet for fresh air, and an outlet for vitiated air; and although this is not absolutely possible in every dwelling-house, that is no reason why a contrary state of affairs should be permitted to obtain.

Where a choice of position can be exercised the principal windows of the house ought to face to the north. A north light in this country is not only more agreeable, but it contributes towards the preservation of such household fur-

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niture as may suffer from direct sunlight. To the naturalist a northern window is a boon, for, in studying the structural details of organic and inorganic nature, especially with the microscope, nothing can be more disagreeable than a strong glare of sunlight, nor can anything be more delightful than a clear diffused northern light. The prevailing winds ought also to be taken into account, but that is a subject which is more nearly related to the special design of the house, and each case must therefore be left to the discretion of the architect.

The isolation of apartments and their efficient ventilation having been provided for, their convenient relative positions next demand a careful study. The lavatories, bath-rooms, and closets, when included within the principal structure, ought to be so situated as in each instance to afford not only ready but unobtrusive access. In every case, the free admission of fresh air and light ought to be secured. The compartments allotted to closets should be most carefully guarded from the other rooms of the house. They should, moreover, be floored with an impervious material, to insure against the evil effects of accident to the pipes, and occupy such a position as to permit of the direct exit of the soil-pipe through the external wall of the building.

The spaces set aside for housemaids' and scullery sinks ought also to be well lighted, ventilated, and sub-externally placed, so as to prevent unnecessary sources of damp. Lastly, the cisterns for water-supply call for special attention in the less expensive houses, since they are almost uniformly neglected. They are not only fastened in inaccessible places, but often in positions which favour the accumulation of filth of every description, not the least harmful among these being that which accrues from the connection of its pipes with, or its contiguity to and beneath, the waste drainage-system of the household. We are thus led to the irresistible conclusion that each individual section of a house, before it can be regarded as thoroughly wholesome, ought to be well ventilated and lighted, free from liability to damp and dirt, conveniently situated, and capable at all times of the most searching scrutiny.

Reviews.

SOME BOOKS ON OUR TABLE.

A Systematic List of the Butterflies of Europe. By H. C. Lang, M.D., F.L.S. (London: L. Reeve & Co.)—This is simply indispensable to the Lepidopterist. An edition is published in which the names are printed on one side of the paper only, to serve as labels for a collection.

Food. Edited by Percy Russell. (London: D. Bain.)—Food is here treated of in its hygienic, historical, culinary, and social aspects. This is a serial which, considering the enormous public it addresses, should have a very wide circulation indeed.

Vere Foster's Painting for Beginners: Studies of Trees in Pencil and in Water-Colours. By J. Needham. (London: Blackie & Son.)—These constitute four volumes of the series known as Vere Foster's Drawing Books. They are all excellently got up, and should prove of inestimable value in the hands of the rising generation.

The Publisher and Bookbuyer's Journal. (London: Wyman & Sons).—The publisher has probably already discovered the value of this serial for himself. It remains for us to point out such value to the bookbuyer, who will find in it a mass of information with reference to works recently published or immediately about to appear. Short reviews of books of the week form one feature of the new serial, while no less than seventeen columns of literary chit-chat present book news in an attractive and readable form.

The Printer's Devil. By "Anglo-Scotus." (London: 3, York-street, Covent-garden.)—At a recent Sunday school examination, a like girl, asked to define "an unclean spirit," promptly replied: "Please, teacher, a dirty devil!" Were we ourselves required to furnish an impromptu definition of the author of this brochure, we should probably describe him as being (like the historical demon of Edmonton)—a very merry Devil indeed. Certainly any one who wants an innocent and hearty laugh (or rather succession of laughs) should straightway invest the very few pence needed to render him the possessor of this amusing collection of typographical blunders and curiosities. Moreover, if unrestrained by ethical considerations, the reader may earn a cheap reputation for wit by retailing as his own some of the good stories with which the "Devil's" little pamphlet is filled.

Handbook for Needlework Prize Associations. (London: Griffith, Farran, Okeden, & Welsh.)—This little book is issued under the direction of the Executive Committee of the London Institute for the Advancement of Plain Needlework, and contains the fullest and most explicit directions for the management of local associations, with details as to the nature of the work to be done in the various competitions, the cost of materials, &c. All who think that it is at least as important that a labourer's wife should be able to make a shift for herself, or knit a pair of socks for her husband, as that she should repeat bits of "Paradise Lost" by rote, and parse sentences from "Rasselas," may read it with advantage.

Rabbits, for Exhibition, Pleasure, and Market. By R. O. Edwards. (London: W. Swan Sonnenschein & Co. 1884.)—Obviously the work of a thoroughly practical man, and an enthusiast to boot. Mr. Edwards's well-written and capitally illustrated volume may be unhesitatingly recommended to the incipient rabbit-fancier. Whether rabbits are to be kept to show or to eat, our author may be regarded as an absolutely trustworthy guide. His chapters on hutches will interest the amateur mechanic; while his directions for feeding, breeding, and the treatment of diseases, leave nothing to be desired. His details of the various "points" of the rabbit which are noted in competing from prizes, will be found very useful by the exhibitor unused to the manners and customs of rabbit shows.

Museums of Natural History. By the Rev. H. H. Higgins, M.A. (Liverpool: D. Murphy & Co. 1884.)—As Chairman of the Museum and Mayer Collection Sub-Committee of the Liverpool Free Public Museum, Mr. Higgins speaks with authority and weight as to the arrangement, classification, exhibition, and care of the objects exhibited in that and allied institutions. His pamphlet may safely be commended to those who are either about to establish a Natural History Museum *de novo* or who may be engaged in an ineffectual attempt to render an existing one popular and profitable in an educational point of view.

Tobacco Talk and Smokers' Gossip. (London: George Redway. 1884.)—A prettily-got-up little pocket-volume, brimful of anecdotes concerning the "weed," which will furnish the smoker with a store-house of arguments for his favourite practice.

We have also on our table *Andrew Marvel and his Friends* (Fourth Edition), by Marie Hall (London: Hodder & Stoughton); the Christmas Number (excellently illustrated) of the *Christian Million*, *The Medical Press and Circular*, *The Tricyclist*, *Bradstreet's*, and *The Season* (with a host of fashion-plates, &c.)

THE ROWLAND HILL BENEVOLENT FUND.

WE have received the following communication from the Lord Mayor:—"Sir,—I desire, with your kind permission, to make a very special and earnest appeal to the public on behalf of the Rowland Hill Benevolent Fund, of which I am a trustee, and which has for its object the relief and assistance of Post Office employés distressed from poverty, age, or infirmity, and of their widows and orphans throughout the United Kingdom. When it is remembered that the number of persons employed in the Post Office is over 53,000, and that cases of distress are very frequent and pressing, the absolute need of some such organisation as this becomes apparent.

"It is not for a moment suggested that the remuneration given to Post-Office employés is less liberal than it should be, but what I venture to urge is that the necessary and unavoidable conditions of the Service bring about, in many instances, distress and hardships which, though unable to be alleviated by a public department spending public money, might well and very appropriately be dealt with through the charitable and compassionate aid of the trading community, and of private donors throughout the country. I may mention incidentally that while such of the employés of the Post Office as have served over ten years are entitled to a pension on retirement, proportionate to the length of their service, persons who have been less than ten years in the department, and who through illness or other causes are obliged to give up their situations, receive nothing but a small gratuity. In the case of the pensioners, the grant absolutely ceases on the death of the individual, and is in no case contiued to his widow or orphans. It is obvious, therefore, that in such a state of things very wide scope is afforded to public benevolence to deal with the numbers of instances in which incapacitated Post Office servants and their families, and the widows and orphans of former employés are involved in great destitution and distress.

"I venture to think that owing to the peculiar conditions incident to the daily work of most of the servants of the Post Office, their exposure to inclement weather and consequent tendency to contract dangerous ailments, they have a special claim upon the sympathy of the public. Again, the very fact of employment in postal work betokens that the employés are persons of exceptionally high character and honesty, and fit to be entrusted with the delivery of those important communications so indispensable to the conduct of trade and commerce throughout the country, and to the requirements of family and public life.

"The Rowland Hill Benevolent Fund has hitherto been so modestly conducted that perhaps its very existence, and, certainly, its needs and merits, have not come prominently before the charitable public. Its annual income is only about £570, and the donations last year amounted to £100. From these sources temporary help was rendered to 74 applicants during the last twelve months, but the small amount at the disposal of the trustees unfortunately precluded them from dealing adequately with many distressing cases brought to their knowledge.

"It is almost impossible to discuss any question bearing on the Post-Office Department, especially in reference to the welfare of its officers, without recurring to the great loss recently sustained by that department by the death of the late lamented Postmaster-General. The trustees of the Rowland Hill Fund have, therefore, resolved to associate his honoured memory with its object by setting apart a limited portion of it—to be called "The Fawcett Memorial Fund"—for the benefit of those employés or their widows or orphans who may be afflicted with blindness.

"In all these circumstances, I have thought it right to open a special fund at the Mansion House, to enable the public to contribute to this very deserving charity; and I earnestly commend it to the attention and sympathy of the country.—I am, sir, your obedient servant, GEORGE S. NOTTAGE, Lord Mayor.

"The Mansion House, London, Dec. 3."

FRESH DISCOVERIES AT THE FISH RIVER CAVES.—These natural subterranean wonders, which more than rival the famous Kentucky Caves, have had their name altered by the New South Wales Government, and will henceforth be known as the Jenolan Caves. The keeper reports that he has made another interesting discovery, having found the entrances to several new caves, the existence of which has hitherto been unknown. Having proceeded a short distance into one of them, he was lowered down over a precipice, at the bottom of which he found a number of fossil bones. Some of the remains are stated to be those of an animal of the tiger species, and the others are at present unknown. The exploration of the interior of the caves was, however, retarded for the time being, owing to their being flooded by heavy rains.

Miscellanea.

WE hear that Dr. J. E. Taylor, F.L.S., &c., the Editor of *Science Gossip* and author of numerous scientific works, is about to proceed to Australia on a lecturing tour. If he only contrives to import the charm of his "Sagacity and Morality of Plants" into his oral addresses, he can scarcely fail to secure very large audiences indeed.

IN a volume recently issued by the United States Census Bureau there is an interesting survey of the history and present condition of the American newspaper press. The list of daily papers in the Union reaches the astonishing average of one for every 10,000 of the population. The number of towns having 10,000 inhabitants and no daily newspaper is declared to be very small. In the United Kingdom the average is one daily paper to about 120,000. —*Athenæum.*

THE National Health Society, which has done so much during the last thirteen years to improve the hygienic condition of the population, and which may be fairly regarded as the pioneer in the present great sanitary movement, appeals for increased subscriptions. All who agree that it would be regrettable that so very obviously useful an institution should be crippled for want of funds may address the Secretary at 44, Berners-street, W.

THE Chairman of the Lancashire and Cheshire Telephone Company (Mr. Chas. Mosley), at a meeting held on Monday, said the Company intended to open "call" offices in various parts of Manchester, Liverpool, and other large towns, as well as at railway stations, and persons using them would be charged threepence per message. Trunk wires would at once be laid which would open communications between Manchester, Liverpool, and other Lancashire towns, and non-subscribers would be able to use the communication at a charge of sixpence for three minutes' conversation. Arrangements had also been made with the National Company, the effect of which would be that the whole of Yorkshire would be placed in communication with Manchester and Lancashire generally. Stations would also be opened in districts around Manchester to bring in domestic subscribers to the exchange.

THE first of a series of popular lectures upon the subject of precautions—national, local, and personal—to be taken against cholera was delivered on Monday evening, at the Parkes Museum of Hygiene, by Mr. Ernest Hart, Chairman of the National Health Society, who treated the subject in its national and international aspect. Director-General Crawford, of the Army Medical Staff, presided. The lecturer having sketched the history of international law and custom on the subject, maintained that quarantine had proved useless and mischievous; it had never kept cholera out of any European country or confined it to any district. Referring to the epidemics at Toulon, Marseilles, and elsewhere, he pointed out that those towns which had invited cholera by their neglect of the first laws of sanitation had suffered the most severely. Rome, with its pure supply of water and its relatively efficient drainage, had remained free from cholera; while Naples, with its ground soil impregnated with sewage, and its filthy habitations and polluted water-supply, had suffered most lamentable losses. He believed that the recent outbreak in Paris was due to the temporary supply of a highly polluted water to various districts. It had been repeatedly demonstrated that the incidence of cholera was in exact proportion to the pollution of the water-supply and the absence of means of carrying off refuse. Cleanliness, in its fullest, widest, scientific, and municipal sense, was the prime element of safety.

THE new installation of the electric light at the Royal Courts of Justice was successfully inaugurated on Monday, and the whole of the lights were kept running until the rising of the judges. The site of the plant is the vaulted basement beneath the Great Hall, in which also is placed the ventilating and warming apparatus for the vast pile of buildings. The electrical plant consists of two single cylinder Galloway engines, each capable of indicating 110-horse power, and supplied with steam from two fine Lancashire boilers. The dynamos are of the Crompton-Burgin type, and eight in number. One engine and one boiler only are employed in the lighting service; the other engine and boiler being in reserve, as is also one of the dynamos. Two of these machines are employed on the six Crompton arc lights which illuminate the Great Hall, and the other five supply current to the 600 incandescent lamps which light the various courts and corridors. The dynamos run at about 1,500 revolutions per minute, and give off 110 ampères current with an electro-motive force of 85 volts. The incandescent lamps are of 20-candle-power light each, and the arc lights of 2,000 candle-power each. The effect of the lighting is very good, and the power of the one engine employed upon the present installation is sufficiently ample to allow of a considerable addition to the lighting being made when required.

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"Let Knowledge grow from more to more."—Alfred Tennyson.

Only a small proportion of Letters received can possibly be inserted. Correspondents must not be offended, therefore, should their letters not appear.

All Editorial communications should be addressed to the Editor of Knowledge; *all Business communications to the* Publishers, *at the Office, 74, Great Queen-street, W.C.* If this is not attended to delays arise for which the Editor is not responsible.

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The Editor is not responsible for the opinions of correspondents.

No communications are answered by post, even though stamped and directed envelope be enclosed.

A STRANGE FORM OF AFTERGLOW.

[1530]—At 5.30 p.m. (local mean time) this evening, my attention was drawn to the abnormal appearance of the sea-horizon. From the south to the west a lurid red glow extended at intervals along the horizon for the complete quadrant. In three places the glow was similar to that caused by large conflagrations viewed from a distance of some miles. At the margins of these places what seemed to be minute tongues of red flame flickered above the sea-line. The sun set at 4.49 p.m. (local mean time), and the evening was dull and cloudy. Thermometer, 68° Fah. The barometer stood at 30.35 in., and had been falling all the afternoon. At 6.50 p.m. the glow gradually faded and disappeared. We do not have much twilight in these latitudes, and when I first observed the phenomenon it was nearly dark. Hundredweight.

Papho, Cyprus, Nov. 17, 1884.

ECONOMY.

[1531]—No one will dispute the proposition of "N." (letter 1506) where he says, "No one can afford, or has any right, to be idle, and were this generally acknowledged and acted upon, a certain stigma would attach to those who lost their time doing nothing." If, in addition to those "doing nothing," we consider what a number of persons are employed in assisting their employers in "doing nothing," it is well seen that with our present social system in the matter of waste we make "assurance doubly sure." Take an instance. A grant of £15,000 a year is expected shortly for an individual who may one day occupy a position of doing nothing. The amount of this grant reckoned as interest at 7 per cent. would represent roughly a capital of £214,000, the consumption of which in farming would require 21,000 acres, and absorb the energies of nearly a thousand individuals working for the bare necessaries of life. As facts should speak for themselves, no comment is required.

C. F. N.

DUODECIMAL NOTATION.

[1532]—From Mexico comes the announcement of the discovery of some curious ancient rock dwellings, cut out of a hill of gypsum, upon the walls of whose rooms are numerous hieroglyphics and representations of human beings cut in the rock. A strange feature of these incised figures is that all the hands have six fingers and the feet six toes.

The reflection forced itself upon my mind as I read this: "How changed would the arithmetic of this day be if our Asian forefathers had had six fingers and toes, like these pictured ancient Mexicans." It would involve the desired compromise between the decimal and the duodecimal system. Our scale of notation would then be duodenary, 12 digits instead of 10, and from this improved decimal system would spring many practical advantages, among the chief being that the decimal would then be divisible by 2, 3, 4, and 6, instead of 2 and 5 only as present.

This looked-for change may yet come with a higher civilisation; but we may, perhaps, expect the new universal language first, and the realisation of a few other ideas of the scientific Utopian.

R. Coupland Thomas.

["There's a divinity," says Hamlet, "that shapes our ends;" and which seems to have acted curiously in this respect in the case of the long-vanished race of Mexicans; unless, indeed, the six fingers and six toes were a mere sculptor's conventionalism, like the profile eye in the Egyptian bas-reliefs. Whether we shall ever have a duodecimal system of notation until a sixth digit is developed on the human hand and foot may well be questioned.—Ed.]

THE SENTIENT EYE THE ONLY COLOUR-BOX.

[1533]—Your correspondent, "Cosmopolitan," still clings to the venerable notion of the *externality* of colour; and until the fact be accepted that colour, precisely as sound, has no external existence whatever, but as mechanical, vibratory action, there can by no possibility be a consistent arrangement of the phenomena of light, nor any intelligible science of chromatics. The phrase, "the light is within us," is not only a scriptural metaphor, but a literal, scientific truth. Light and sound are the phenomena alone of the sentient eye and of the sentient ear. Light is the *tertium quid* of the contact of vibratory action with the inner optic sense, just as sound is of mechanical atmospherical vibrations with the auditory sense. That which is actually perceived by the sensorium is, indeed, merely a property or change of condition of our nerves. Why a simple mechanical vibration should in the ear produce sound, and in the eye the sensation of light, will in all probability never be ascertained. But the fact shows us that there are phenomena which defy scientific analysis. It is a fact of which, it has always appeared to me, metaphysicians might have made much. The action of vibratory bodies on the organ of hearing is entirely mechanical. If the action of the mechanical cause on the ear be of continued duration, the sound is also continued, and when caused by a rapid succession of uniform impulses or vibrations, it produces a musical sound; but the unthinking attribute externality to the sound, and to the note, just as they do to light and to colour. The undulatory and mechanical theory of light does not posit more than that the different periodicities of the mechanical vibrations produce in us different sensations of light, different sensations of colour. If a mechanical vibration, plus something else, were required to produce a sensation of colour, the undulatory theory, as it stands, would be insufficient.

External agencies can give rise to no kind of sensation which cannot also be produced by internal causes. Colour, light, and darkness may be perceived independently of all external exciting causes. The appearance of light and of luminous flashes may be excited in the closed eyes independently of any external causes. Everyone is aware how common it is to see bright colours while the eyes are closed. These phenomena are very frequent in children after waking from sleep. And even a person blind from infancy, in consequence of opacity of the transparent media of the eye, must have a perfect internal conception of light, colour, provided the optic nerve be free from lesion.* Light and colours are innate endowments of our nature, and merely require a stimulus to make them manifest. By the corpuscular or emissive hypothesis, colours might be supposed to be inherent in the corpuscules; but we cannot entertain the same notion with respect to the corpuscules of the ether waves, for, if we did, the ether particles, chameleon-like, would have to change their colour to adapt themselves to the different periodicities of their vibrations. This shows very forcibly that light, colours, can by no possibility have externality other than as vibratory action, and that the eye itself is the only colour-box in nature. This admitted, the whole science of chromatics, as popularly understood, has to be reconstructed. The fact, indeed, is admitted by all thinkers on the Continent, and by a few thorough scientists in England. Nevertheless, the science of chromatics lingers on in the sloughs of error by the misleading of the Newtonian nomenclature and false hypothesis. Primaries, secondaries, &c., come of the thinking founded on the dead Newtonian hypothesis, not on the undulatory theory. W. Cave Thomas.

53, Welbeck-street, Nov. 26, 1884.

NO MATTER.

[1534]—Respecting the letter by Mr. I. W. Alexander on "Matter," (1518, p. 451) it is very confusing, if not irrational, to say that matter never alters, and then to maintain that it can be destroyed—*i.e.*, reduced to nothing, to be re-created afresh out of nothing! The materialistic idea, as explained by Haeckel ("Pedigree of Man," page 231), is:—"We must hold that atoms are the smallest separate particles of masses, having an unalterable nature, separated one from another by hypothetical ether. Every atom has an inherent sum of force, and is, in this sense, gifted

* There are many other facts which might be adduced to show that the eye itself is the real seat of light and colour.

with a soul. Without the acceptance of an atom-soul, the commonest, the most general phenomena of chemistry are inexplicable. Pleasure and displeasure, desire and loathing, attraction and repulsion, must be common to all masses of atoms; for the movements of atoms which must occur in the formation and decomposition of every chemical compound, are only explicable if we impute to them sensation and will," &c.

Mr. Alexander will see that materialism needs not an "outside" power; it places "force" within the atom as its innate property. Besides, matter is nowhere "isolated." Atoms exert force on one another incessantly. F. W. H.

FOSSIL AND MODERN EYES.

[1535]—Your correspondent, E. L. Garbett, probably never saw a mole which lives underground in darkness. Its eyes are so small that they are scarcely perceptible. That would prove that creatures living—if such a thing could be thought possible—before there was a sun, light, and warmth, should have had no eyes, or at least very small, diminutive ones. F. W. H.

[1536]—In suggesting that big eyes in animals of the earlier times might imply them to have lived in the days before there was a sun, I should have said this was on the assumption of their optic nerves having somewhat our own relative sensitiveness to the variously refrangible rays. We must bear in mind that rays which are *light*, and rays which are *not* light, are a distinction purely human, or having reference to human physiology. There may be animal eyes ever so near us, even the dog's, to which the yellow may be obscure, and those we call "obscure heat," or "obscure actinism," be the brightest. We cannot tell, of any eyes but our own, that a boiling kettle is less luminous than a candle to them. There may be eyes to which the kettle's rays are light, and the candle's no more so than the ultra-violet actinic rays are to us. To them also the Andromeda nebula may be brighter than Sirius, and things in the starry heavens that are the brightest to them may be for ever invisible to us, though, perhaps, to be photographed on some chemical yet unknown. Far more, then, may there have been, when the sun was a nebula, nerves to which rays that we should call dark heat served as light, and the co-existence of small eyes with the abnormally large ones can prove nothing. Trilobites' eyes appear to have resembled in structure those of modern insects, but in scale they greatly exceeded those of their present equals in bulk, whether as near them in class as shrimps and crayfish, or as distant as birds or mice. E. L. GARBETT.

Nov. 30, 1884.

[Save in the case of the ichthyosaurus, it cannot be said that any fossil type of animal was distinguished by abnormally large eyes. I had two beautiful specimens of trilobites before me as I wrote, and assuredly their eyes were not so big relatively as those of the modern dragon-fly. No physiological warrant whatever exists for Mr. Garbett's ideas of what "may be." They are as pure and absolute guesses as the speculation of the negro metaphysician:—

"'Spose that I was you, and 'spose that you was me,
And 'spose we all was somebody else—I wonder who we should be?"

—ED.]

LETTERS RECEIVED AND SHORT ANSWERS.

ISIDORE. Unfortunately for your hypothesis, the phenomenon has been just as striking when the sun has been in apogee.—G. W. M. The difficulty of reproducing the lectures in a book-form arises from the fact that they were extemporaneous. Your complaint that subjects are commenced in these columns and not finished is not wholly without foundation. On the other hand, correspondents complain of the length of some of the very series whose non-completion you resent. "Almanack Lessons" and "Star-Mapping" will be resumed, and "Papers on Spectrum Analysis" commenced, all in good time. Your reference is an erroneous one.—CHARLES BLOOMFIELD. Surely in asking for hints for a "small" observatory "50 feet high (!) and 12 diameter" there must be a *lapsus calami*?—F. YELWOC. If you wish my candid opinion, I should say that it is impossible.—HAWTHORNS. Assuming the coin to be a genuine and unweighted one, the first four tosses in no sense whatever affect the probability that of the remaining eight four will be heads and four tails.—J. S. B. Address the Secretary, 14, Dean's-yard, Westminster, S.W.—J. W. HOWELL. Many thanks for the trouble you have kindly taken, but the question has been already answered (*vide* column two, page 472).—C. F. N. Your mental experience in connection with a neuralgic attack unfortunately only too common a one.—W. H. STONE writes, concerning the paragraph on "Non-poisonous Water Pipes" (column one, page 453), that he is the original inventor of tin-lined lead piping; that he pointed out the advantage of it to Messrs. Davidson & Armstrong, of Manchester, thirty or forty years ago, and that, between the years 1848 and 1852, that firm laid down pipes so tin-lined for the Manchester Corporation.—F. W. RUDLER. Received with thanks.—J. E. FUIT (?). Delayed through your addressing the *Editor* instead of the Publishers.—W. ST. C. BOSCAWEN. Letter received, but no tickets enclosed.—MR. WALLACE. "Richmond of" was apparently a misprint for "of Richmond." A letter addressed to Mr. Wright, Richmond, Yorkshire, would probably elicit the required information. See concluding paragraph, in capital letters, which heads the Correspondence Column.—OAKLEY. There is not the very slightest ground for the belief that the Star of Bethlehem will reappear in 1887. No temporary star of the appearance of which any authentic record whatever exists, could in the least fulfil the conditions of the phenomenon to which Matthew ii., vv. 2, 9, and 10 refer. Ideler long ago suggested that a conjunction of Jupiter and Saturn, which occurred B.C. 7, would do so; but this view was speedily shown to be untenable. As for "total eclipse of Sun and Moon *said* to take place about the same time," this is much too vague; as eclipses of the sun total over certain parts of the earth's surface, and total eclipses of the Moon, visible wherever she is above the horizon, are common enough. There was an eclipse of the Moon 3 B.C., March 13. The position of a star or planet in the day-time can only be found by setting the circles of an equatorially-mounted telescope. Two things will prevent Wolf's Comet being seen from Kimberley: the strength of the present summer twilight, and the comet's recession from the earth.—CONSTANT READER. No explanation has ever yet been given of the *modus operandi* of Maskelyne & Cooke's automata; nor can I personally make any guess that would be worth listening to.—REV. C. H. COPE. Thanks. Your tracing is from a sketch of contorted strata of the "Millstone Grit" (a group in the Carboniferous formation). These strata, originally deposited horizontally, have been crumpled by lateral pressure in a way which you may understand if you put pieces of coloured cloth one on another with a book on the top of them, and then press them strongly at the sides. Such convolutions are by no means uncommon. I heartily agree with you, though, as to the utilitarian spirit of the age. The finest view, the most precious archæological relic, the most interesting geological section—nothing is sacred to a "board" or a jobbing builder.—T. L. CRAWFORD. Much too long for insertion.—H. HANCOCK writes, in connection with the effect of the moon's rays, that while in India in 1857-58, a shipmate who slept by his side on deck had a moonstroke; his head swelling so fearfully that the locality of his eyes was only discernible by his eyebrows; while the left side of his mouth was drawn nearly up to his ear. Medical men subsequently informed our correspondent that blindness, epilepsy, paralysis, and idiocy often supervened on such an attack. Mr. Hancock himself has had sunstroke, and earnestly cautions everyone who may have been affected either by the solar or lunar rays to abstain from subsequently drinking spirits.—H. A. (if I understand him, which is, to say the least, questionable) thinks that, just as mustard-seed or an acorn extracts its proper nutriment from the soil which surrounds it, and developes into a bush or an oak tree, as the case may be, so a soul may extract its nourishment from "spiritism," of which he alleges that "not more (nay, less) universal is air itself."—F. J. WARDALE. Clausius and Thomson have shown that pressure must raise the melting-point of solids; at least, such solids as *expand* in becoming liquid. In the extremely few which contract (like water) the reverse is the case. Comparatively nothing is known of the internal temperature of the earth.—R. F. H. No "local inundation" could by any possibility submerge a mountain 500 ft. high! Extremely slow subsidence might do so in the course of ages, but then the mountain would remain submerged. On June 16, 1819, a tremendous earthquake occurred at Cutch, on the delta of the Indus. By this convulsion the Eastern Channel of the Indus, which had been only one foot deep at low water, was deepened to 18 ft., at which it remains. Of course, the disturbance was confined to a limited area. Water always, as you say, "finds its own level;" hence, for it to overflow a mountain or anything else, the latter must be *depressed*. I am, I regret to say, wholly ignorant of naval architecture.

IN the lead production of different countries, Spain holds the first place, the amount reaching some 120,000 tons in one year, or one-sixth more than America, which comes next on the list, while Germany follows with 90,000. Of Spain's total production, some 67,000 tons are derived from one district, that of Linares, in which more than 800 mines are registered.

XUM

Our Inventors' Column.

So great is the number of inventions now patented that many good things are comparatively lost in the crowd. A succinct account, therefore, by an Expert, of all inventions of really popular interest and utility must be advantageous both to the public and the Inventor, enabling persons to hear of inventions already desiderated by them, and thus acting reciprocally as a stimulant on supply and demand.

THE MULTIPLE CLOCK.

Clocks having more than one face have hitherto been among the greatest difficulties in horology. The advantage of an ordinary clock with two or three faces is for many positions obvious. Messrs. Blumberg & Co., of Paris and London, have now patented an invention which marks an entirely new departure in clock-making. This invention is known as the "multiple" clock, and is claimed to surpass all known methods of working a clock with a number of dials, inasmuch as it possesses but one movement, which may be placed in any part of the case, and not necessarily in juxtaposition to the dial or dails. It is therefore obviously possible to place the "multiple" clock in positions, and to apply it to purposes not practicable for clocks provided with the ordinary mechanism. Patterns of the "Multiple" clock are now to be seen at the warehouses of the manufacturers in London, at 2, Cannon-street, and in Paris at 64, Rue de Bondy. They are prepared to supply the clock in a large number of designs to suit a variety of requirements, including use in private houses, hotels, reading-rooms and public institutions, railway stations, offices, banks, and ships' saloons. The "Multiple" clock is also made to be suspended from the roof or ceiling at any elevation, a simple mechanism allowing it to be drawn down for winding or cleaning, &c. The "Multiple" clock may be made, too, so as to show the time in different parts of the world simultaneously.

IMPROVED DOOR-KNOBS.

Nearly everyone has had irritating experience of the imperfect way in which door-knobs are usually connected and fastened to the spindle, the fastening being generally quite an infinitesimal quantity of screw, which soon ceases to "bite" after a little wear and tear. Mr. E. V. Bailey, of Birmingham, has invented what is claimed to be an improved form of connection, suitable for most kinds of door-handles, but particularly the movable knobs of lock spindles and cupboard turnlocks. In this invention a knob is fixed at one end of the spindle, at the other end to the spindle the knob is movable. The hole in the neck of the movable knob is screwed at the back with a screw-thread for taking upon the screwed end of the spindle. The front of this hole is square or angular. For determining the position in which the movable knob can be passed on to the screwed end of the spindle a sliding-collar is used, which has a square or angular bush, to match or fit the square or angular hole in the neck of the movable knob. To fix the handle the rose is secured at the end of the spindle, inserted through the door. On the protruding screwed end of the spindle the sliding-collar is passed until it reaches the door. The movable knob is screwed up, and a peculiar pattern of rose-plate screwed on to the spindle to prevent the knob being withdrawn from the spindle.

REGISTERING THE FAMILY MILK SUPPLY.

There is no end to the ingenuity of inventors in these days. It is well known by all housekeepers that milk is frequently tampered with after delivery, and the blame cast unjustly on the milkman. A London dairyman, to obviate this evil, has invented an appliance for receiving and registering the quantity of milk daily supplied to a family. The apparatus has the further advantage of a great saving of cans to the milk vendor. The appliance consists of a framework and stand, which is fixed on the inside of the door, and communicating with it on the outside is a dial-plate numbered 1 to 12, with a hand for pointing, and below this an opening, consisting of a pipe, through which the milk is poured into the vessel placed inside to receive it. The inner outlet of this pipe has a movable plate that passes to and fro over it as required, and there is a certain amount of simple mechanism connected with it. Each figure on the dial represents quarts, and dots between half-pints, and it is presumed the dial is sufficient to indicate a week's supply. Presuming the dial to stand at *nil*, and the domestic being ordered to set it at Fig. 1, representing a quart, she moves the hand, which is actuated by means of a spring, and can only be turned in one direction to that figure, and places the jug upon the stand formed to receive it. This stand is connected with a chain and balance-weight, which in its turn acts upon the plate that moves over the spout, and the weight of the jug depresses the stand, causing the balance-weight to rise, and the plate to move aside, and so open the spout, ready for the milkman to deliver the quantity registered on the dial. This operation is repeated prior to each delivery, and at the week's end the supply received is noted, and the dial reset for the following week.

The manufacturers of this article are Messrs. Bodill, Parker, & Co., of Great Hampton-row, Birmingham.

A NEW COPYING APPARATUS.

In these busy days, the demand for cheap and effective copying-machines is ever on the increase. Several appliances of this kind have recently reached us from the Continent, and one known as the black autocopyist has just been introduced from Germany. The apparatus in question is simple in make, and consists of a wooden frame in which a prepared parchment sheet is fixed. This sheet must be soaked in water for a few minutes, which is effected on the frame itself, after which the original is placed for a minute on the parchment-sheet. By aid of a printing-roller copies can then at once be taken. The frame is fitted with two springs, which span the parchment, and reclean it when necessary. The process is simple and easy, and requires no special training on the part of the copyist, while the precision of the copies taken is undoubted, and the facsimiles closely resemble those obtained by lithography. The autocopyist is introduced by the Autocopyist Company, of 72, London-wall, London, E.C. Circulars, notices, price-lists, music, &c., can by its means be reproduced, and the striking feature is that the original is easily written with an ordinary pen.

IMPROVED GLAZING.

The skylight, and for the matter of that, glazing in general, are open to great improvement, and for one thing we should like to see putty disestablished together with the barbarous "hacking" knife, required as often as a new pane of glass has to be put in. The British Patent Glazing Co., Limited, of 24, Finsbury-circus, have introduced a system of patent glazing patented by Mr. Joseph D. Mackenzie, lately of Glasgow, which appears to have many advantages. It not only supplies the means of securing the glass without the aid of putty or other plastic fixing, but forms part of the framework of the construction. The glazing bar or sash bar is what is known as a composite one, formed of solid rolled malleable iron of a T form, inverted, having the cross well rolled into a U shape, thus forming gutters in each side of the vertical part of the bar, for carrying off any moisture or condensation. The iron is coated with a good anti-corrosive paint, or a bituminous substance, if desired, after which it is enveloped in sheet lead or other soft ductile metal or alloy.

The composite bars are fixed at convenient distances apart, the glass is laid upon the soft metal, which acts as a cushion and prevents breakage through shocks or vibrations. Channels are provided in the bar for carrying away the moisture, and the sectional strength of the bar is increased by giving the cross web an arch form. The work can be done in any weather, and no periodical outlay for putty and paint is necessary. There are other advantages claimed for what seems to be a decidedly improved system of glazing.

A HYDRAULIC DOOR-SPRING.

The shutting of doors is, in many cases, a matter of some importance, and one that, doubtless, should be as nearly as possible automatic. Messrs. Archibald Smith & Stevens, of the Janus Works, Queen's-road, Battersea, London, S.W., furnish some interesting particulars of what is known as Stevens & Major's patent hydraulic spring and check for swing doors, and for regulating the closing of doors so as to prevent banging. The spring is made to fix flush with the floor, and can be even covered with a carpet, and acts as a hinge also. Assuming that this invention does efficiently what it professes, it should prove very useful. The patentees give the following general description of the principle of action:—"The spring is placed within a small pump barrel. On opening the door, a charge of oil is drawn from the containing-box into the pump. The spring, while closing the door, has to expel this charge of oil through a small aperture, the size of which is adjustable, and the rate of closing is controlled by the speed at which the oil is allowed to escape. All parts are of metal, and, as oil is constantly passed through, every part is always perfectly lubricated." Simple means of regulating the action for faster or slower closing are provided.

Colliers and their Lamps.—It is stated that at Walker Colliery, near Newcastle, the miners have been asked to take down Marsaut lamps instead of the old Clanny and Davy lamps, but have objected, and have struck to the number of 300, leaving the colliery idle

Our Whist Column.

By Five of Clubs.

HERE is the preface of the new treatise on Whist, by "Five of Clubs," called "How to Play Whist," now in the press:—

PREFACE.

The following chapters on the Theory and Practice of Whist originally appeared in KNOWLEDGE, and there had the advantage of the criticisms and suggestions of some of the finest exponents of the game. These criticisms have in many cases led to important modifications and improvements. The treatise has no claim to novelty as regards Whist principles; in fact, outside the modern signalling system and the absolute rejection of the singleton lead, there is very little difference between the Whist of to-day and the Whist of Hoyle and Matthews.

The method of presenting the leads here adopted is much more easily followed than that usually employed. Learners are deterred by the multitudinous rules for leading from such and such hands, but grasp at once the rules for leading such and such cards. The gain in simplicity is great. For instance, there are hundreds of hands from which the Ace is "the correct card" to play, while there are only two conditions under which Ace should be lead originally; moreover, when these two conditions have been noted, the meaning of an Ace lead is recognised at once. So it is with the two original King leads, the one original Queen lead, and so forth. In less than half an hour, by the method supplied here, the right card to lead and the right meaning of the each lead, can be fully learned. I have extended the same method, as far as possible, to play second hand and third hand.

As regards the general conduct of the game the chief point of novelty in this work is that I have been careful to correct the common error that, because scientific Whist involves the long suit system at starting, therefore the whole play of each hand should proceed on that system. Many of the rules which beginners learn are suitable only for the long suit method; yet there is scarcely one hand in ten in which one side or the other has not to give up (sometimes quite early) all idea of bringing in a long suit. If I were asked what I regarded as the most valuable working quality in a partner, I should answer—Readiness in determining whether an aggressive game, aiming at the introduction of a long suit, should be entered on, or a defensive policy pursued. The original discard tells your partner which line you are taking.

With regard to the system of signalling, I sympathise with the objections which have been urged against it by many fine players; but the system *must* be learned by all who wish to play Whist successfully. It must be learned for defence if not for attack. A player is not much worse off than his fellows if he determines *and lets his partner know he has determined*, never to *use* the Trump signal, the Echo, or the Penultimate. He may even safely determine never to *respond to* the Signal,—indeed with too many partners this is a most necessary precaution. Yet he can never escape the duty of *noticing* the signals. If he fails to do so, he will ere long find himself forcing the enemy's weak Trump hand and omitting to force the strong (mistaking a response to the signal for an original Trump lead) or committing some other Whist enormity. But I incline to judge from the objections of Pembridge, Mogul, and other strong players, to the signalling system, that they have not noticed its full meaning. For they speak of the Echo and Penultimate as if these signals were seldom available, instead of coming in—either in their positive or negative form—far oftener than the Signal for Trumps itself. Especially is the Penultimate Signal of frequent use. Scarcely a hand is played without it. If my partner always leads the lowest but one from a five-card suit (not headed by cards requiring a high card lead) then if he leads a Two, or a card which is shown by the play of the others or by my own hand to be the lowest of his suit, I know that he has not more than three cards left in the suit; and if the lead is not a forced one, I can infer pretty safely that he has just three left. This may prove most important knowledge, not only by showing the limits of his long suit, but by guiding me as to forcing the enemy in that suit. If the Penultimate is not played in this negative way by my partner, it will probably be so played (or played in the positive form) by the adversaries. I put myself and my partner at a disadvantage, then, if I fail to observe this signal.

The full importance of the signalling system can only be understood when we recognise *six* signals—thus:—

1. If } you have commanding strength in Trumps, and at
2. Unless } least one long and strong suit { *signal* / do *not* signal } for trumps.

3. If } you have at least four Trumps { *echo* / do *not* echo } in
4. Unless } response either to the signal or to your partner's Trump lead.

5. If } you have at least five cards in a suit play the
6. Unless } { lowest but one / lowest card } except where the leading cards are such that a high card has to be played.

So understood, signalling goes on in almost every game. But I cannot too carefully warn the learner to be most chary of displaying the Trump signal; and especially to reject, as altogether unsuitable for *him*, Pole's rule, that you should always signal from five Trumps.

My own experience has been that the various signals, so far from taxing the memory, serve greatly to help it. This had been already noticed in the case of the customary rules for leading, discarding, returning leads, and the like. Every act of attention to a rule helps to record the play in the mind. I cannot, indeed, understand why there should be any more effect in noticing signals than in trying to ascertain *in other ways* (as by examining your hand at starting) your prospects of success or failure.

The learner will soon find that at times he must go counter to the customary rules if he would win or save a game. Hand XXVII., p. 158, is a remarkable case in point. Here Mr. Lewis neither led Trumps from five, nor Ace from Ace four others in his long plain suit; because to have followed either rule would have been running counter to the only rule of play which is absolutely general—PLAY TO WIN.

The forty illustrative games are nearly all from actual play. They are chiefly intended to illustrate Whist principles, the way of forming inferences at Whist, and so forth. Several are fine examples of Whist strategy. A few have been selected as examples of bad play. They differ from any such series hitherto published in being fully annotated,* and in having the full hand of each player displayed (with score, trump card, &c.), as if set round the Whist Table itself. The games (contributed to KNOWLEDGE originally) by Mr. Lewis are particularly valuable.

The Whist Whittlings include Whist stories, maxims, notes, curiosities, and problems.

To make the work complete, the Laws and Etiquette of Whist are added, and a Glossary of Whist Terms in more or less common use.

"FIVE OF CLUBS."

As an instance of rapid telegraphy, says the *Japan Mail*, the following item from the record of the Yokohama telegraph office is not without interest:—A telegram was handed in at Yokohama at 3.10 p.m., and was received in London at 8.27 a.m. (time of transmission, two hours thirty-seven minutes). An inquiry arising from the message was given in at London at 10.43 a.m., and received in Yokohama at 8.40 p.m. (time of transmission, thirty-seven minutes, deducting nine hours twenty minutes, the difference in time between London and Yokohama). The reply was forwarded from Yokohama at 9.50 p.m., and reached London at 3.21 p.m. (time of transmission, two hours fifty-one minutes). Thus the whole transaction—forwarding the telegrams, the receiver in London making further inquiry, the examination at this end before replying, and the delay occasioned by the messages having to wait their turn for transmission—occupied as nearly as possible the time of the sun's passage between the two places.

ALISANDERS, or ALEXANDERS.—It is commonly believed that this old pot-herb has long been extinct; but in many Midland districts, especially where mining is a leading industry, it will be found in the cottage gardens, and is regularly employed in the flavouring of soups. Amongst a similar class on the Continent the plant is in equal favour, and, in fact, it takes the place of celery where this better plant is not grown. It is a British plant that may often be met with on waste ground near the sea, and seems partial to ruins. It is the *Smyrnium olusatrum* of the books, a plant of ancient renown for its mild aromatic flavour. When in vigorous growth the leaves reach a height of two to three feet, the stems are stout and deeply furrowed, the leaves alternate, a vivid green colour, the whole plant very closely resembling celery. It does not flower the first year, but in the second puts up a head of yellowish-green umbels, which are followed by black seeds or nuts. Although belonging to the suspicious umbelliferous order, every part, root included, is perfectly wholesome, and when put into soup communicates a flavour similar to that of celery.—*Amateur Gardening*.

---

* Of the five games given by Prof. Pole, two are unsound, the play approved being bad; two are merely examples of play from overwhelming strength, and the fifth (and last) is merely a Whist curiosity.

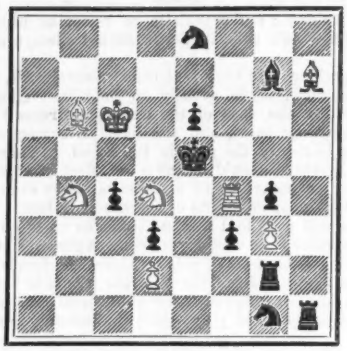
Our Chess Column.

By Mephisto.

PROBLEM No. 140.

By B. G. Laws.

Black.



White.

White to play and mate in four moves.

SOLUTIONS.

Problem No. 137, p. 454.

1. P to Q6.

1. P to K4. 2. Q to QR7, K to K3, Kt3, B5. 3. Q to Q7, R7, B2, mate.

1. K to K4. 2. Q to B sq., K to Q5, B4. 3. Q to B3 or Kt5 mate.

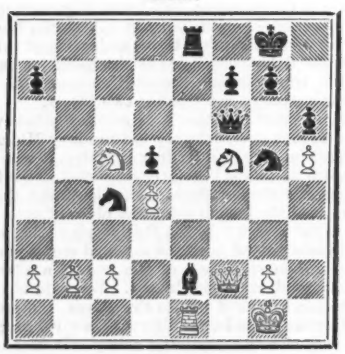
1. K to B5. 2. Q to B5, K to B6. 3. Q to B2 mate.

Problem No. 138.

1. B to R8 !		K to R2
2. Q to QR sq.		K to Kt2
3. Q to Kt7 (ch)		Mate.
1.	if	K to B2
2. Q to B2 (ch)		Any
3. Q mates.		

ENDING FROM ACTUAL PLAY.

Black.



White.

Black played—

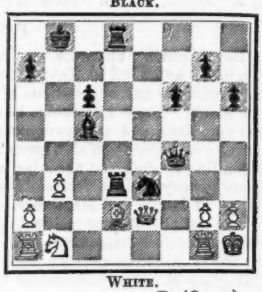
	Kt to B6 (ch) ?
Q × Kt !	B × Q
R × R (ch)	K to R2
Kt to Q7 !	Q to B3
Kt to B8 (ch)	K to Kt sq.
Kt to K7 (ch)	K to R sq.
Kt (B8) to Kt6 (ch)	K to R2
R to R8 (ch)	Mate.

Game played at Bradford between Mephisto and a member of the Bradford Club :—

Two Knight's Defence.

White. Amateur.	Black. Mephisto.	White. Amateur.	Black. Mephisto.
1. P to K4	P to K4	24. R to Kt sq.	Q × P (*e*)
2. Kt to KB3	Kt to QB3	25. B to Q2	
3. B to B4	Kt to B3		
4. Kt to Kt5	P to Q4		
5. P × P	Kt to QR4		
6. B to Kt5 (ch)	P to B3		
7. P × P	P × P		
8. B to K2	P to KR3		
9. Kt to KB3	P to K5		
10. Kt to K5	B to Q3		
11. P to Q4 (*a*)	P × P (en pas)		
12. Kt × P	Q to B2		
13. P to KB4	B to R3		
14. Castles	Castles (QR)		
15. B to Kt4 (ch) (*b*)	K to Kt sq.		
16. Q to B3 (*c*)	Kt × B		
17. Q × Kt	B × Kt		
18. P × B	B to B4 (ch)		
19. K to R sq.	R × P		
20. B to Q2 (*d*)	Kt to B5		
21. B to B3	P to B3		
22. Q to K2	KR to Q sq.		
23. P to QKt3	Kt to K6		

Black.



White.

	R (Q sq.) to Q5 (*f*)
26. R to Q sq. (*g*)	Q × P (ch)
27. K × Q	R to R5 (ch)
28. K to Kt sq.	Kt × R (ch)
Resigns.	

NOTES.

(*a*) Here the book recommends 11. P to KB4.

(*b*) Results in loss of time and weakness; White ought to have tried to bring out his pieces by Kt to B3.

(*c*) This breaks up his position, having given a useless check. The best he could do was either to retire his B to B3 or play K to R sq.

(*d*) White thought it was inadvisable to capture the KtP, and tried to make up for lost time by bringing out his pieces.

(*e*) Black is playing for something big, as he might have won at least an exchange by Kt to Q8.

(*f*) Q to K4 would have resulted in a substantial gain, but this move possessed more attraction.

(*g*) A necessary precaution, although of little avail. R to K sq. was better than this. The likely-looking move of 26. Q to B3 would also lose by Q × P (ch). 27. K × Q, R to R5 (ch). 28. The Q must interpose, then Kt to Kt5 (ch), &c.

ANSWERS TO CORRESPONDENTS.

*** *Please address Chess Editor.*

W.—You are quite right; the position is analogous to Pearson's Problem, but it is altogether impossible, which upsets the whole "apple-cart," as the White B could not possibly be on K8.

H. A. L. S.—We did not publish the above as a Problem.

A. W. Orr.—There is no harm in 2. P to QB4. You need take no notice of it, but play B to B4 or Kt to B3 as usual.

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